Repair Manual

Jetta 2013 ➤

Generic Scan Tool									
Engine ID	CNL A								

Edition 08.2022

List of Workshop Manual Repair Groups

Repair Group

ST - Generic Scan Tool

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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ST – Generic Scan Tool

1 General Information

(Edition 08.2022)

Included in the contents of this Generic Scan Tool (GST) manual is a summary table of the vehicle specific OBD II Emission Related DTCs. The DTC table contains DTC Malfunction Criteria, Threshold Values, Secondary Parameters, Enabling Conditions, Monitoring Time Length, Frequency of Checks, and MIL Illumination information which can be used to accurately monitor and diagnose emissions related faults and perform functions required to run Modes 01 through 0A (if applicable) with a hand held scan tool.

This manual also contains the step by step procedures to accurately diagnose and repair a component or system once a DTC has been set. References to repair procedures and wiring diagrams can be found within the diagnostic test procedures.

- ⇒ P1.1 recautions", page 2
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1.1 Safety Precautions

Check for Technical Bulletins that may supersede any information included in this manual.

WARNING

Failure to follow these instructions may result in personal injury or possible death.

Check the Technical Bulletins for information, cautions and warnings that may supersede or supplement any information included in this manual.

When performing the drive cycle operation, pay strict attention to driving conditions and observe and obey all posted speed limits.

Test equipment must always be secured to the rear seat and operated by a second person. If test and measuring equipment is operated from the passenger seat, the person seated could be injured in the event of an accident involving deployment of the passenger-side airbag.

The fuel system is under pressure! Before opening the fuel system, place rags around the connection area. Then release pressure by carefully loosening the connection.

The engine section of the fuel system, after the high pressure pump, is under extremely high pressure! When working on engine or fuel injection system, fuel pressure must be relieved to residual pressure before opening high pressure components. Refer to the Service Manual for the proper procedure.

If the battery has not been disconnected, the fuel pump fuse must be removed before opening the fuel supply system as the fuel pump may be activated by the driver's door contact switch.

Testing of the EVAP and ORVR systems can result in the escape of explosive fuel vapor. Do not smoke while testing the EVAP system, and make sure the area you are working in is well ventilated.

Observe the following for all procedures, especially in the engine compartment due to lack of room:

- *Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.*
- *Watch for sufficient clearance to all moving or hot components.*
- *Do not touch or disconnect the Ignition Coils, ignition wires, connecting parts or adapter cables when the ignition is on or the engine is running or turning at starting RPM.*
- *Only disconnect and reconnect wires for injection and ignition system, including test leads, when the ignition is turned off.*

When removing and installing components from full or partially full fuel tanks, observe the following:

- *The fuel tank must only be partially full. How much fuel can remain in the fuel tank may be read in the respective work description. Empty the fuel tank if necessary.*
- *Before starting work, switch on the exhaust extraction system and place an extraction hose close to the installation opening of the fuel tank to extract escaping fuel fumes. If no exhaust extraction system is available, a*

radial fan (as long as motor is not in air flow) with a displacement greater than 15 m^3/h can be used.

- *Prevent fuel from contacting the skin! Wear fuel-resistant gloves!*

When servicing the engine control module (ECM), it may be necessary to use a heat gun. The heat gun, shear bolts, and parts of the protective housing will become extremely hot. Use extreme caution when working with or handling these parts to avoid personal injury.

Observe operating instructions when working with a heat gun. To prevent damage (burning) to the wiring and harness connections, insulation and the electronic components, perform outlined work steps exactly!

The cooling system is under pressure. To avoid scalding, use caution when opening the cooling system and servicing cooling system components!

Caution

The battery must only be disconnected and connected with the ignition switched off. Otherwise, the engine control module (ECM) can be damaged.

The use of nails, paper clips, or another unauthorized materials to back-probe harness connectors is strictly prohibited and may cause damage to the harness connectors, terminal ends or to a component. Use only the manufacturers test lead kit or an equivalent aftermarket test lead kit for back-probing all harness connectors.

Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be burned in the engine and will damage the oxygen sensors.

Secure all hose connections with the correct hose clips (the same as original equipment).

If engine is to be cranked without starting (for example; as part of a compression test), remove the fuses for the voltage supply of ignition coils and the fuel injectors.

An electrostatic charge can lead to functional problems of electrical components of the engine, transmission and selector lever mechanism. Touch a grounded object, e.g. a water pipe or a hoist, before working on electrical components.

Do not make direct contact with harness connector terminals.

Use only gold-plated terminals when servicing any component with gold-plated harness connector terminals.

1.2 Clean Working Conditions

Even minor contaminations can lead to malfunctions in the fuel injection system. When working on the fuel supply/injection system, pay careful attention to the following rules of cleanliness:

- Thoroughly clean all connections and the surrounding area before disconnecting.
- Place removed parts on a clean surface and cover. Use lint-free cloths.
- Carefully cover opened components or seal, if repairs are not performed immediately.

- When the system is open, do not work with compressed air. Do not move vehicle unless absolutely necessary.
- Install clean components: Remove the parts being replaced immediately prior to installation of the new parts. Do not use parts that have been stored unpacked (e.g. in tool boxes etc.).
- Electrical connectors that have been disconnected: Protect from dirt and moisture. Make sure connections are clean and dry when reconnecting.

1.3 High Voltage System General Warnings

Before performing any work on the high voltage system, always check with the importer if there are any questions regarding the terms “technician trained in electrical systems”, “high voltage technician”, “high voltage expert”, “high voltage systems”, or “hybrid systems”. Qualifications necessary for most of these terms are also provided below ⇒ page 9 .

Before beginning work on the high voltage system, a high voltage technician ⇒ page 9 , must de-energize the high voltage system. Refer to appropriate repair manual for high voltage system de-energizing.

For a list of work procedures requiring the high voltage system to be de-energized, refer to the tables listed below in: Working on the High Voltage System, Conventional Work Near High Voltage Components, and General Work ⇒ page 6 .

WARNING

Read and follow the information below when de-energizing the high voltage system to reduce the risk of fatal injury.

- *Only a qualified technician (high voltage technician) should disable the high voltage system.*
- *The high voltage technician (HVT) makes sure the system is de-energized and cannot be re-energized again.*
- *The high voltage technician assures that the system cannot be re-energized again by safely storing the key, the High Voltage System Maintenance Connector -TW- and the pilot line connector.*
- *The high voltage technician (HVT) puts a sign on the vehicle saying the voltage is disabled.*
- *Only hybrid electrically instructed persons may perform all work (maintenance, tire changing, Convenience System) on vehicles with a high voltage system. If there is any uncertainty, discuss with the responsible high voltage technician.*
- *A high voltage technician must disable the system before any work can be performed on the high voltage electrical system or any other service work to the body.*
- *Only a high voltage expert (HVE) may perform repairs to the vehicle if it is not possible to disable the high voltage electrical system.*
- *Individuals with electrical medical equipment must not work on vehicles with a high voltage electrical system. Examples of electrical medical equipment include pain medication pumps, implanted heart defibrillators, pacemakers, insulin pumps and hearing aids.*

WARNING

Working with high voltage cables:

- *Do not support yourself or lay tools on the high voltage cables or on any of its components.*
- *When working near high voltage components and high voltage cables, do not use tools that generate heat, that have sharp edges or that are used for cutting or shaping, such as welding, soldering, hot air or thermal adhesive equipment.*
- *When working near high voltage components and high voltage cables, do not use tools that generate heat such as welding, soldering, hot air or thermal adhesive equipment.*
- *Do not excessively bend or flex high voltage cables.*
- *Always contact a high voltage technician (HVT) if there are questions or if something is not clearly understood.*

Check the contact surfaces on the potential equalization cables before installation.

The contact surfaces must be clean. There must be no rust or grease on them.

Follow all guidelines for clean working conditions.

Observe the following precautions when working on the high voltage system:

- Only technicians who are trained in electrical systems should work on high voltage system (hybrid) vehicles.
- When working on a hybrid vehicle, always inspect the hybrid components in the area where the work is being performed.
- Do not excessively bend or flex high voltage cables.
- Always contact a high voltage technician or a high voltage expert specializing in electrical systems if something is not understood or if there are questions.
- All the work described below is referencing removing, installing and replacing the individual components.

Working on the High Voltage System

During the Following Work	Minimum Qualifications, refer to ⇒ page 9
De-energizing the high voltage system	High voltage technician
Re-energizing the high voltage system	High voltage technician

When Working on the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
Electro-Drive Drive Motor -V141-	X		Technician trained in electrical systems
Electric Drive Power and Control Electronics -JX1-	X		Technician trained in electrical systems

When Working on the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
High Voltage System Maintenance Connector -TW-		X	Technician trained in electrical systems
Electric A/C Compressor High Voltage Cable -P3-	X		Technician trained in electrical systems
Drive Motor High Voltage Wiring Harness -PX2-	X		Technician trained in electrical systems
High Voltage Wiring Harness For High Voltage Battery -PX1-	X		Technician trained in electrical systems
Hybrid Battery Unit -AX1-, Removing and Installing	X		Technician trained in electrical systems
Charging the Hybrid-Battery -A38- with High Voltage Battery Charger -VAS6565-	X		High voltage technician
Battery Regulation Control Module -J840-	X		High voltage technician
Battery Fan 1 -V457-		X	Technician trained in electrical systems
Air guides next to the Hybrid Battery Unit -AX1-		X	Technician trained in electrical systems
Air guides under the Hybrid Battery Unit -AX1-	X		Technician trained in electrical systems
Electrical A/C Compressor -V470-	X		Technician trained in electrical systems
Drive Motor Temperature Sensor -G712-	X		Technician trained in electrical systems
Drive Motor Rotor Position Sensor 1 -G713-	X		Technician trained in electrical systems
Three-Phrase Current Drive -VX54-	X		Technician trained in electrical systems
Electrical Drive Button -E656-		X	Technician trained in electrical systems
Fuse Electrical A/C Compressor -V470- in Electric Drive Power and Control Electronics -JX1-	X		Technician trained in electrical systems
Potential equalization cable (Ground [GND] wires)	X		Technician trained in electrical systems
Working on the coolant circuit for the high voltage components	X		Technician trained in electrical systems
Measuring insulation resistance	X		High voltage technician
Working when the system is de-energized and the ignition is on	X		Technician trained in electrical systems

Conventional Work Near High Voltage Components

When Working on the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
Spark plugs		X	Technician trained in electrical systems
Catalytic converter		X	Technician trained in electrical systems

When Working on the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
Exhaust System		X	Technician trained in electrical systems
Coolant reservoir		X	Technician trained in electrical systems
Front brakes		X	Technician trained in electrical systems
Decoupler	X		Technician trained in electrical systems
Internal Combustion Engine, Removing and Installing	X		Technician trained in electrical systems
Transmission without Electro-Drive Drive Motor -V141-, Removing and Installing	X		Technician trained in electrical systems
Fuel Tank		X	Technician trained in electrical systems
Front subframe		X	Technician trained in electrical systems
Rear axle		X	Technician trained in electrical systems
Underbody Trim		X	Technician trained in electrical systems
Welding (Cover high voltage components with non-combustible materials and then perform a visual inspection)	X		Technician trained in electrical systems
Vehicle Body Work (Using an Alignment Bench)	X		Technician trained in electrical systems
When working near high voltage components and high voltage cables, do not use tools that generate heat, that have sharp edges or that are used for cutting or shaping, such as welding, soldering, hot air or thermal adhesive equipment (Cover high voltage components with non-combustible materials and then perform a visual inspection).	X		Technician trained in electrical systems
Left Front Headlamp -MX1-, Removing and Installing		X	Technician trained in electrical systems
Right Front Headlamp -MX2-, Removing and Installing		X	Technician trained in electrical systems
Headlamp Bulbs, Removing and Installing		X	Technician trained in electrical systems

General Work

When Working On the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
12V Battery, removing and installing		X	Technician trained in electrical systems
General controls modules and electric components, 12V, removing and installing		X	Technician trained in electrical systems

When Working On the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
Fluids, coolant and fluids, draining and filling		X	Technician trained in electrical systems
Refrigerant extracting, evacuating, filling		X	Technician trained in electrical systems
Refrigerant pipes directly to the A/C compressor	X		Technician trained in electrical systems
A/C System, flushing		X	Technician trained in electrical systems
Peripheral refrigerant line (work that does not involve the A/C compressor directly without opening the refrigerant circuit, for example, loosening and tightening the refrigerant line)		X	Technician trained in electrical systems
Work with the engine raised, engine mount	X		Technician trained in electrical systems
Emissions test		X	Technician trained in electrical systems
Follow the instructions in the paint handbook when performing any paint/drying work		X	Technician trained in electrical systems

Qualification Explanation

Qualification	Area of Application
Hybrid electrically instructed person	May perform general work and Maintenance services on the vehicle. May be requested by the high voltage technician to perform mechanical work on the tension-free high voltage system.
High voltage technician (HVT)	The high voltage technician has the same authorization as a technician trained in electrical systems due to their qualifications. The high voltage technician can also: ♦ 1. De-energize the system. ♦ 2. Secure the system so that it cannot be energized again. ♦ 3. Ascertain that the system is definitely de-energized (certified measurement). ♦ 4. Assign work on the high voltage system to the hybrid electrically instructed person. ♦ 5 Put the vehicle back in operation.

Qualification	Area of Application
High voltage expert (HVE)	A high voltage expert (HVE) is actually a high voltage technician (HVT) but with an extra qualification that allows them to de-energize the high voltage system in the case that a high voltage technician is not able to perform measurements with the standard tools and equipment. The high voltage expert must continue the work if the high voltage technician does not have the authority to work on the high voltage system. The high voltage expert is responsible exclusively to de-energize the high voltage system if it cannot be de-energized by the high voltage technician using the usual means or methods.

2 Description and Operation

- ⇒ B2.1 oard Diagnostic Systems", page 11
- ⇒ E2.2 mission System", page 11
- ⇒ T2.3 hrottle Control (ETC) System", page 13
- ⇒ P2.4 ower Control (EPC) Warning Lamp", page 13
- ⇒ C2.5 ontrol Module (ECM)", page 14
- ⇒ I2.6 ndicator Lamp (MIL)", page 14
- ⇒ A2.7 rea Network (CAN)", page 14
- ⇒ S2.8 upply", page 15
- ⇒ a2.9 nd Timing", page 16
- ⇒ V2.10 alve Timing", page 17
- ⇒ R2.11 ecirculation (EGR) System", page 17
- ⇒ A2.12 ir Injection", page 17
- ⇒ S2.13 ystems", page 18

2.1 On Board Diagnostic Systems

On Board Diagnostics, or OBD, is an automotive term referring to a vehicle's self-diagnostic and reporting capability. OBD systems give the vehicle owner or repair technician access to the status of the various vehicle sub-systems. Modern OBD implementations use a standardized digital communications port to provide real-time data in addition to a standardized series of Diagnostic Trouble Codes (DTCs) which allow one to rapidly identify and remedy malfunctions within the vehicle. Legislation mandates a vehicle equipped with OBD-II to light up the fault indicator lamp if its emissions exceed the prevailing limit due to system malfunction.

All cars built since January 1st, 1996 (MY 1996) are equipped OBD-II systems. Manufacturers started incorporating OBD-II in various models as early as 1994; however, some early OBD-II cars (MY 1994 and MY 1995) were not 100% compliant.

2.2 Evaporative Emission System

The evaporative emission system has been designed to minimize the release of hydrocarbons from the fuel system into the atmosphere. The evaporative emission system components all work together with the ECM to prevent fuel vapor from escaping and route it to the intake manifold to be burned during normal combustion.

The leak detection system checks the integrity of the evaporative emission system by pressurizing the system.

- There are 3 different types of evaporative emission systems used. These systems are explained below.

- ⇒ D2.2.1 etection Pump (LDP) EVAP System", page 12
- ⇒ L2.2.2 eak Diagnostic Module (DM - TL) EVAP System", page 12
- ⇒ V2.2.3 acuum Leak Detection (NVLD) EVAP System", page 12
- ⇒ S2.2.4 ystem, Checking For Leaks", page 12

2.2.1 Leak Detection Pump (LDP) EVAP System

The leak detection pump (LDP) is integrated into the EVAP system and can have two functions. The LDP can:

- Pressurize the EVAP system and detect a drop in pressure that would indicate a leak.
- Function as the EVAP Canister Vent on vehicles that do not have a separate EVAP Canister Vent.

The LDP is a vacuum-driven, ECM controlled, diaphragm pump. In order to operate, the engine must be running and vacuum applied to the Vacuum Switch.

2.2.2 Tank Leak Diagnostic Module (DM - TL) EVAP System

The canister purge valve can be actively checked using the Tank Leak Diagnostic Module (DM - TL). For this purpose the electric pump is shortly activated while the combustion engine is running, to build up a minor pressure in the fuel tank and monitor the pressure decay after opening the canister purge valve. Optionally as a quick pass method, the monitoring can be carried out by passively monitoring the fuel mixture deviation when the canister purge valve is opened. If a significant fuel mixture deviation is detected, the purge valve monitor passes. The Tank Leak Diagnostic Module (DM - TL) consists of an electrically operated air pump, an orifice with a defined diameter serving as a reference leak, and a change-over valve switching the air flow between the reference leak and the tank. If neither the pump nor the change-over valve is activated, the tank is ventilated through a bypass in the module.

2.2.3 Natural Vacuum Leak Detection (NVLD) EVAP System

The system utilizes an engine-off natural vacuum evaporative system integrity check that tests for leaks with a diameter of 0.020 inch while the engine is off and the ignition is off. The natural vacuum leak detection (NVLD) evaporative system integrity check uses a pressure switch to detect evaporative system leaks. The correlation between the pressure and the temperature in a sealed system is used to generate a vacuum in the tank when the temperature drops. If a sufficient temperature drop is detected for a minimum time period, the vacuum level in a sealed system will exceed the threshold to close the NVLD pressure switch. Therefore, if the switch does not close under these conditions, a leak is detected. If the switch closes, the system is considered to be leak-free.

2.2.4 EVAP System, Checking For Leaks

The following procedure is used to diagnose EVAP System leaks.

Special tools and workshop equipment required

- Smoke tester.
- EVAP and Fuel Supply System Vacuum hose and line routing diagram.

Leak checking

– Using a Smoke tester, check the Evaporative Emission (EVAP) canister system for leaks.

– Always follow the manufacturers directions for the proper installation and operation of the smoke tester being used.

If a leak is detected:

- Check the fuel filler cap seal for damage and for proper installation. Replace if necessary.
- Check all hose connections of the fuel supply system and replace or repair any leaking lines.
- Check all hose connections of the EVAP system and replace or repair any leaking lines.
- Check that the seal under the locking flange is properly tightened on the fuel tank.
- Secure all hose connections using appropriate fittings for the model type.
- Replace seals and gaskets when performing repair work.
- Repair or replace any damaged component.

If no leaks are found in the EVAP system:

- Erase the DTC memory if a DTC was set. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 .
- Perform a road test to verify repair.

If a DTC was set and does not return:

Diagnosis complete. Generate readiness code. Refer to ⇒ C3.2 ode ", page 21 .

If the same DTC does return and no leaks are found in the EVAP system:

- Check for any related TSB's.
- Perform the diagnostic test procedure for the suspected component.

2.3 Electronic Throttle Control (ETC) System

The electronic throttle control (ETC) system consists of the accelerator-pedal module, the engine control module (ECM), and the electronic throttle body. The electronic throttle body mainly consists of the throttle valve, the electric throttle-valve drive element, and the throttle-valve position sensor (TPS). The drive element is a DC servomotor, which acts on the throttle-valve shaft via a gear unit. The throttle-valve position sensor is a redundant sensor system that detects the position of the throttle valve. The sensors have opposite resistance curves so that the ECM can always cross check the signals to ensure the correct position of the throttle valve is always known.

The driver command is detected by a redundant sensor system in the accelerator-pedal module, and the signal is sent to the engine control module. The engine control module then determines the required throttle-valve position by performing calculations from data measured by sensors such as accelerator pedal position sensor, engine speed sensor and vehicle speed sensor. The actual throttle opening can be more or less in proportion to accelerator pedal position given different engine operating points.

2.4 Electronic Power Control (EPC) Warning Lamp

When the ignition is switched on, the engine control module (ECM) checks the electronic throttle control system for static system integrity (e.g. circuit integrity, communications, etc); the electronic power control (EPC) warning light is turned on via the Instrument Cluster during this process. Shortly after engine

start, the EPC warning light is turned off if no malfunction in the electronic throttle control system is detected. In the event of a malfunction while the engine is running, the ECM will activate the EPC warning light via the Instrument Cluster and at the same time, a Diagnostic Trouble Code (DTC) is stored in the ECM memory.

2.5 Engine Control Module (ECM)

The Engine Control Module (ECM) is a generic term for any embedded system that controls one or more of the electrical systems or subsystems in a vehicle. It controls a series of actuators on an internal combustion engine to ensure that driver commands (e.g. to accelerate) are translated into appropriate engine performance. It reads values from a multitude of sensors, interprets the data, and adjusts the engine actuators accordingly. The ECM also interacts with the transmission control module (TCM), ABS/traction/stability control module and other vehicle function related control systems.

ECM controlled systems and functions (performance and emission related) will be introduced in the following chapters. These include the OBD system, controller area network (CAN), throttle control module, fuel supply, ignition, variable valve timing, exhaust-gas recirculation, secondary air injection, exhaust system, and EVAP system.

2.6 Malfunction Indicator Lamp (MIL)

When the ignition is switched on, the Engine Control Module (ECM) performs checks on static system integrity (e.g. circuit integrity, communications, etc). The Malfunction Indicator Lamp (MIL) is switched on during this process via the Instrument Cluster. After engine starts, the ECM examines engine operation for potential malfunction(s) or failure(s) that can lead to increased emission values. If no malfunction is detected, the ECM switches off the MIL via the Instrument Cluster.

In the event of a malfunction during the operation of the engine, the ECM will activate the MIL via the instrument cluster and at the same time, a Diagnostic Trouble Code (DTC) is stored in the ECM memory. In OBD systems, the MIL can have up to three stages: steady, flashing and Stop Vehicle. A steady MIL indicates a minor fault (e.g. a failing oxygen sensor) whereas a flashing MIL indicates a more severe malfunction that could result in damage of engine or exhaust system components (e.g. the catalytic converter) if left uncorrected for an extended period. This would also indicate a severe fault. The three stages are 1. ON, then OFF; 2. ON steady; 3. flashing constantly. The 3rd stage indicates damage may occur and driver must stop.

2.7 Controller Area Network (CAN)

Overview

The Controller Area Network (CAN) bus is a message-based protocol that allows control units and devices to communicate with each other using a shared network. With this system, control units of the various electronic systems are no longer interconnected by multiple separate cables. This does away with a large number of electrical connections and results in a reduced likelihood of failure of the device network.

Broadcast Communication

Each of the devices on the network has a CAN circuit and is therefore is considered “intelligent”. All devices on the network see all transmitted messages. Each device can determine if a message is relevant or if it should be filtered out. This structure allows modifications to CAN networks with minimal impact. Ad-

ditional non-transmitting nodes can be added without modification to the network.

Priority

Every message has an assigned priority. If two nodes try to send messages simultaneously, the one with the higher priority gets transmitted and the one with the lower priority gets postponed. This arbitration does not affect other messages and results in non-interrupted transmission of the highest priority message

2.8 Fuel Supply

Overview

The fuel supply system delivers fuel to an internal combustion engine. With carburetors being replaced by fuel injections systems in the late 1980s and 1990s, the most common types of fuel supply system currently in use are throttle body injection (single-point injection), multiport injection (MPI) and direct injection (DI).

Fuel injectors atomize fuel because high pressure is forcing the fuel through a small nozzle in the injector into the intake air stream or the combustion chamber. This process is often controlled by the ECM and is dependent on data received from other sources (e.g. mass air flow sensor, throttle position sensor, etc.) to determine the precise amount of fuel needed for any given operating condition. The primary advantages of fuel injection over carburetor are improved fuel economy, increased power output and reduced emissions. The following sections will discuss each fuel injection concept in detail.

Throttle Body Injection

Throttle body injection uses a single electrically controlled injector at the throttle body. The fuel is drawn by an electric fuel pump out of the fuel tank and flows through a paper filter into the fuel injector. Since injection happens at the same location as the carburetor, very little engine redesign (intake manifold, fuel line routing, etc.) is necessary. The cost saving of throttle body injection compared to other fuel injection methods encouraged vast adoption in the late 1980s and early 1990s.

Throttle body injection system also inherits many disadvantages of the carburetor. One of them being the inability to precisely control the amount of fuel supplied into each cylinder, and is unable to precisely control combustion and emissions. It also restricts the design of intake manifold as any sharp bends in the intake path will cause atomized fuel to accumulate on the outer wall of the intake path. Supplying moderate engine heat to the intake manifold is also necessary to ensure that the fuel stay vaporized. This results in a relatively high intake air temperature and compromises performance.

Multiport Injection (MPI)

Multiport injection (MPI) consists of an injector for each cylinder just upstream of the intake valve. The fuel pump delivers the fuel into a high-pressure line where it flows to the fuel rail and injectors. When activated by the ECM, each injector sprays fuel at the intake port of its corresponding cylinder – this allows individual cylinders to receive the right amount of fuel in a more precisely timed manner. Sequential fuel injection mode can be applied to activate each injector individually to improve engine response. Lowered fuel consumption and emissions are also achieved.

Sequential multiport injection is still the most common fuel injection system found on most economy cars thanks to its high efficiency, control simplicity and low manufacturing cost (compared to direct injection). However, to further improve drivability

(performance) while reducing emissions and fuel consumption, direct injection becomes a superior alternative.

Direct Injection

Injectors in directly injected (DI) engines are mounted on the cylinder head and fuel is injected directly into the engine's combustion chamber. In order to overcome the pressure in the combustion chamber during compression and power stroke, injectors often operate at a primary pressure as high as 3000 psi. At such extreme pressure level, no single fuel pump can supply the required pressure directly from the fuel tank to the injectors. Instead, a low-pressure and a high-pressure system are employed. The low-pressure system principally utilizes the same fuel systems and components for multiport injected engines. The high-pressure system consists of a high-pressure fuel pump driven directly by the camshaft, a fuel rail (high-pressure accumulator), a high-pressure sensor and, depending on the system, a pressure-control valve or a pressure limiter. The injectors are operated by the ECM to send a precise amount of fuel from the high-pressure rail directly into the combustion chamber.

The distinctive difference between direct injection and other injection methods is that direct injection offers the flexibility regarding when in the combustion cycle the fuel is added and how. MPI systems can only add fuel during induction; A DI system can add fuel whenever it needs to. For example, fuel can be added during induction to create a homogeneous charge then added again after ignition to enhance power delivery under full load conditions.

VW/Audi Fuel Stratified Injection (FSI)

The goal of a stratified-charge operation is to form an ignitable mixture near the spark plug at the instant of ignition. This means that, instead of supplying the corresponding stoichiometric fuel quantity to the amount of air in the combustion chamber, the fuel interacts only with a portion of the air before it is conveyed to the spark plug. The rest of the fresh air surrounds the stratified charge allowing an ultra-lean condition with air-fuel ratio exceeding 50:1 in some instances. As less fuel is used to "burn" more air, stratified injection helps to further reduce fuel consumption when the engine is operating in low-load conditions (e.g. highway cruising). This is created by designing the combustion chamber so that a "swirling" effect of the air-fuel charge is caused.

2.9 Ignition and Timing

Ignition

A spark ignition (SI) engine requires a spark to initiate combustion in the combustion chamber. Voltage is supplied to the spark plug where the electricity will arc across a gap at a voltage as high as 100 kilovolts. The ECM determines the precise moment to fire each spark plug using ignition logic which is preprogrammed into the ECM as a function of engine speed and load. An optimally calibrated ignition system ensures consistent and reliable ignition under all conditions. Knock or misfire as a result of incorrect ignition can lead to destruction of engine components or damage of the catalytic converter.

Timing

Shifts in the moment of ignition (ignition timing) can result in increased emissions, decreased performance and fuel economy. Whereas more spark advance improves power and fuel economy, it also raises HC and NOx emissions. Excessive spark advance can cause engine knock which is potentially destructive to engines. If the ECM detects knock from a signal sent by a knock sensor, it will delay (retard) the timing of the spark. Excessive spark retard lowers power output and produces high

exhaust temperatures, which can also harm the engine. Carefully designed ignition logic provides optimum timing that best balances performance, fuel economy and emissions.

2.10 Variable Valve Timing

Engines equipped with variable valve timing provide the option of adjusting the phase of the camshaft with respect to the crankshaft. This allows the ECM to control the time at which the valves open or close, and therefore better assists engine "breathing" at various engine speeds. When engine speed increases, the duration of intake and exhaust stroke shortens so that less fresh air can be drawn into the combustion chamber and less exhaust gas can escape. In such a scenario, the ECM opens the intake valve before the exhaust gas has completely left the combustion chamber, and their considerable velocity assists in drawing in the fresh charge – this is referred to as "valve overlap".

In addition to valve timing, some engines also employ variable valve lift that switches to a more aggressive camshaft-lobe profile as engine speed increases. A more aggressive camshaft-lobe profile actuates valves more rapidly and lifts valves to a greater magnitude in comparison to a normal camshaft-lobe profile. This improves intake and exhaust flow rate, allowing engines to raise maximum operating speed and power output.

2.11 Exhaust-Gas Recirculation (EGR) System

Exhaust-Gas Recirculation (EGR) can be utilized to control the cylinder charge and therefore the combustion process. The exhaust gas that is recirculated to the intake manifold increases the proportion of inert gas in the fresh gas filling; this results in a reduction in the peak combustion temperature and, in turn, a drop in temperature-dependent NOx emission.

Exhaust-gas recirculation is made possible by a connection between the exhaust pipe and the intake manifold. Due to the pressure differential, the intake manifold can draw in exhaust gas via this connection. Together with the exhaust-gas recirculation valve, the ECM adjusts the opening cross-section and therefore controls the partial flow tapped from the main exhaust flow. A malfunction in exhaust-gas recirculation system can result in performance loss and increased emissions. In such a scenario, the Malfunction Indicator Lamp (MIL) lights up and a Diagnostic Trouble Code (DTC) is stored in the ECM memory.

2.12 Secondary Air Injection

Additionally injecting air into the exhaust pipe triggers an exothermic (release of heat) reaction. This leads to the combustion of HC and CO components that prevail mainly during the warm up phase. This oxidation process releases additional heat. Consequently, the exhaust gas becomes hotter, causing the catalytic converter to heat up at a faster rate. For spark-ignition engines, secondary-air injection is an effective means of reducing HC and CO emissions after starting the engine and to rapidly heat up the catalytic converter. This ensures that the conversion of NOx emissions commences earlier.

An electronically controlled valve operates the secondary-air valve (a one-way check valve). The ECM actuates the pump and the control valve, ensuring that secondary air can be injected at a defined point in time. The secondary air must also be injected as close to the outlet valve as possible in order to exploit the high temperatures to utilize the exothermic (release of heat) reaction effectively.

2.13 Exhaust Systems

Overview

There are three important functions of the exhaust system: to reduce the pollutants in exhaust gas, muffle engine combustion noise and to discharge exhaust gas at a convenient location on the vehicle (often underneath the rear bumper). A passenger-car exhaust system consists of the following; exhaust manifold, exhaust treatment components, sound absorption components and the system of pipes connecting these components.

Exhaust Manifold

The manifold is an important component in the exhaust system. It routes the exhaust gas out of the cylinder outlet ports into the subsequent exhaust system. The geometry of the manifold (i.e. length and cross-section of the individual pipes) has an impact on the performance characteristics, the acoustic behavior of the exhaust system, and the exhaust temperature. In some cases, the manifold is insulated with an air gap to quickly reach high exhaust temperature and to shorten the time taken by the catalytic converter to reach its operating temperature.

Emission Control

The primary emission control component is the catalytic converter, which breaks down the gaseous pollutants in the exhaust gas (CO, HC and NOx). Catalytic converters are installed as close as possible to the engine so that they can quickly reach their operating temperature and therefore be effective in urban driving. It also bears a sound-absorbing function, especially to the higher frequency portion of the engine combustion noise.

Sound Absorption

Mufflers dampen or absorb the noise produced by engine combustion. In principle, they can be installed at any position in the exhaust system. However, they are mostly located in the middle and rear sections of the exhaust system. Depending on the number of cylinders and engine output, generally 1 to 3 mufflers are used in an exhaust system. In V-engines, the left and right cylinder banks are often run separately, each being fitted with its own catalytic converters and mufflers. Although the aim of mufflers is to reduce noise in compliance with legislations, they can also help to create the sound specific to the type of vehicle.

3 Diagnosis and Testing

- ⇒ C3.1 heck ", page 19
- ⇒ C3.2 ode ", page 21
- ⇒ M3.3 odes 01 - 0A", page 22
- ⇒ D3.4 TC Table", page 43
- ⇒ D3.5 TC Table", page 133
- ⇒ D3.6 rive DTC Table", page 166
- ⇒ D3.7 TC Table", page 182
- ⇒ P3.8 rocedures", page 212

3.1 Preliminary Check

Note

- *Before performing any pin point test or component diagnosis, a Preliminary Check must be performed.*
- *Check for Technical Bulletins that may supersede any information included in the repair manual or GST Manual.*

- For Electrical Testing: Refer to ⇒ page 19 .
- For Fuel System Mechanical Testing: Refer to ⇒ page 20 .
- For Oxygen Sensor Preliminary Tests: Refer to ⇒ page 20 .

Electrical Testing

Step	Procedure	Result / Action to Take
1	• CONNECT: Scan Tool. • IGNITION: ON. • CHECK: For stored or related DTCs. – Were any other DTCs stored?	– YES: ◆ GO TO: Step 2 ⇒ page 19 . – NO: ◆ GO TO: Step 3 ⇒ page 19 .
2	• Repair these DTCs first before performing any of the following steps.	◆ GO TO: Proper Diagnostic procedure per the stored DTC. Refer to ⇒ D3.4 TC Table", page 43 .
3	• Using the Scan Tool, erase the DTC memory. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . • Perform a road test to attempt to duplicate the customers complaint. – Does DTC return?	– YES: ◆ GO TO: Step 4 ⇒ page 19 . – NO: ◆ GO TO: Step 5 ⇒ page 20 .
4	• Perform the diagnostic procedure for that DTC.	◆ GO TO: Proper Diagnostic procedure per the stored DTC. Refer to ⇒ D3.4 TC Table", page 43 .

Step	Procedure	Result / Action to Take
5	• FAULT: Intermittent or a sporadic condition. • CHECK: Suspected components. • PERFORM: Visual Inspection of wiring and components. • CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. • REPAIR: Faulty wiring or connector.	♦ Perform a road test to verify the repair. ♦ Generate readiness code. Refer to ⇒ C3.2 ode ”, page 21 .

Fuel System Mechanical Testing

Check the following items for possible mechanical delivery deficiency:

- Fuel level in tank is too low.
- Fuel lines pinched.
- Fuel filter plugged.
- Fuel pump delivery unit internal leak.
- Clogged injectors.
- Poor fuel quantity delivery. Refer to appropriate repair manual.

Oxygen Sensor Preliminary Tests

Check for the following conditions which can cause Oxygen Sensor Faults to set without requiring Oxygen Sensor replacement:

Common issues for lean faults:

♦ Vacuum leaks - check for failed or loose vacuum lines, leaking intake gaskets, or any other source of un-metered air leaks (leaks after the Mass Air Flow Sensor).

♦ Restricted fuel filter or bent/pinched fuel system lines.

♦ Incorrect input from other sensors, such as the Mass Air Flow Sensor, which may not always set a fault.

♦ Engine misfire.

♦ Exhaust leaks.

♦ Camshaft timing.

Common issues for rich faults:

♦ Leaking or faulty fuel injector.

♦ Fuel injector driver shorted in ECM, or wiring short for injectors (short to ground).

♦ Leaking or faulty fuel pressure regulator or restricted return line.

♦ Faulty fuel pump or fuel pump driver module.

♦ Incorrect input from other sensors, such as the Mass Air Flow Sensor, which may not always set a fault.

♦ Aftermarket components or performance chips.

♦ Camshaft timing.

3.2 Readiness Code

Caution

When performing the Readiness drive cycle operation, pay strict attention to driving conditions and observe and obey all posted speed limits.

Readiness code description

Diagnostics are performed at regular intervals during normal vehicle operation. After repairing an emissions related system, a readiness code is generated by road testing the vehicle.

If a malfunction is recognized during the drive cycle, it will be stored in the DTC memory.

The OBD drive cycle operation will be monitored with a hand held diagnostic tool. Consult the manufacturer's instruction manual for correct tool operation.

The readiness code is erased every time the DTC memory is erased or any time the battery is disconnected. If the DTC memory has been erased or the battery is disconnected, a new readiness code must be generated.

Only erase the DTC memory if a DTC has been stored.

General recommendations

Most monitors will complete easier and quicker using a “steady-foot” and “smooth” acceleration during the drive cycle operation.

Operating conditions

For the EVAP monitor test, the coolant temperature and the ambient air temperature must be between 10° C and 35° C with a difference between them no greater than 4° C. The ambient air temperature must not change more than 4° C during the drive cycle procedure (e.g. when driving out of a heated workshop in the winter).

Note

Do not assume that the scan tool ID and engine code are correct if the scan tool communicates. The scan tool does not use the ID to establish communication—the units are automatically identified.

Test requirements

- NO DTC in memory.
- Switch OFF all electrical and electronic accessories.
- Necessary driving speed: 50 – 70 mph.
- Drive profile takes approximately 60 – 90 min.

Readiness Drive Cycle Procedure

– CONNECT: Scan Tool.

Step	Procedure	Result / Action to Take
1	Activate Monitors: • START: Engine and idle for 2 – 3 min.	♦ Monitoring Active. ♦ Executes Misfire Monitoring.

Step	Procedure	Result / Action to Take
2	O2 Sensor Monitoring: • DRIVE: Vehicle at 45 – 55 mph for a continuous 7 minute period. Avoid stopping.	♦ Executes O2 Sensor Monitoring. ♦ Executes Fuel Trim Monitoring. ♦ Executes EVAP Monitoring.
3	Fuel Cut-Off Monitoring: • ACCELERATE: Vehicle to an engine speed of 5,000 RPM; lift off the throttle until the engine speed is around 1,200 RPM.	♦ Fuel Cut-Off Monitoring Ready.
4	Catalyst Monitoring: • ACCELERATE: Vehicle smoothly to 60 – 65 mph, cruise at a constant speed for 5 min.	♦ Executes Catalyst Monitoring. ♦ Executes O2 Sensor Monitoring. ♦ Executes Fuel Trim Monitoring. ♦ Executes Misfire Monitoring. ♦ Executes EVAP Monitoring.
5	Secondary Air Injection, EVAP Monitoring: • DRIVE: Vehicle for 30 – 40 min. at a constant speed of 50 – 70 mph in high gear for 2 min. with no coasting.	♦ Executes Secondary Air Injection Monitoring. ♦ Executes EVAP Monitoring. • Check the status of the readiness code.

– If any engine monitor fails the drive cycle test. Repeat the drive cycle test until all engine monitors have successfully run through and passed.

Note

♦ *When repeating the drive cycle operation for a failed evaporative or thermostat monitor, allow the engine to cool until the coolant temperature and the ambient air temperature are between 10° C and 35° C with a difference between them no greater than 4° C and then repeat the drive cycle operation.*

♦ *Depending on the scan tool used, the readiness code status may be displayed as complete, passed or OK. At an ambient air temperature < 7° C, the setting of the readiness for the NOx catalytic converter test is delayed. Here the vehicle must be driven considerably longer.*

Readiness Codes and Monitoring Completed

1 - If any engine monitor fails the drive cycle test, repeat the drive cycle test until all engine monitors have successfully run through and passed.

2 - If the drive cycle operation fails again:

3 - Check the DTC memory for stored DTCs.

4 - Repair the vehicle if necessary.

5 - Repeat the drive cycle operation until all engine monitors have successfully run through and passed.

6 - Remove the scan tool and switch the ignition off.

3.3 Diagnostic Modes 01 - 0A

The information provided in Modes 01 through 0A displays the various levels of emission related data that may be monitored, as well as the ability to retrieve and read stored DTCs, erase stored DTCs, generate readiness codes, and select the various

PIDs and Test IDs used within the modes to monitor the engine, and emission related component parameters.

- ⇒ E3.3.1 ngine Control ModuleJ623 Diagnostic Mode 01 - Read Current System Data", page 23
- ⇒ B3.3.2 attery Regulation Control ModuleJ840 Diagnostic Mode 01 - Read Current System Data", page 25
- ⇒ E3.3.3 lectrical Drive Control ModuleJ841 Diagnostic Mode 01 - Read Current System Data", page 25
- ⇒ E3.3.4 ngine Control ModuleJ623 Diagnostic Mode 02 - Read Operating Conditions", page 26
- ⇒ B3.3.5 attery Regulation Control ModuleJ840 Diagnostic Mode 02 - Read Current System Data", page 27
- ⇒ E3.3.6 lectrical Drive Control ModuleJ841 Diagnostic Mode 02 - Read Current System Data", page 28
- ⇒ M3.3.7 ode 03 - Read DTC Memory", page 29
- ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30
- ⇒ M3.3.9 ode 06 - Read Test Results for Specific Diagnostic Functions, 2013 – 2014 MY", page 31
- ⇒ M3.3.10 ode 07 - Read Faults Detected During the Current or Last Driving Cycle", page 39
- ⇒ M3.3.11 ode 08 - Request Control of On-Board System, Test or Component", page 40
- ⇒ M3.3.12 ode 09 - Read Vehicle Information", page 40
- ⇒ M3.3.13 ode 0A - Permanent Fault Codes", page 41

3.3.1 Engine Control Module -J623- Diagnostic Mode 01 - Read Current System Data

Note

Depending on scan tool and protocol used, the information in diagnostic mode 01 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).

Diagnostic Mode 01 makes it possible to access current emissions-related measured values and diagnostic data. The original measured values (no replacement values), input and output data and system status information are displayed using Diagnostic Mode 1.

Test requirement

- Coolant temperature at least 80° C.

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

– Select "Diagnostic Mode 1: Obtain data".

– From the following table, select the desired the "PID" that is to be monitored, e.g. "PID $05 Coolant Temperature".

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
$01:	Monitoring Status Since Erasing DTC Memory
$03:	Condition Of Fuel System
$04:	Calculated Load Value
$05:	Coolant Temperature
$06:	Short Term Air Fuel Ratio
$07:	Long Term Air Fuel Ratio
$0B:	Intake Manifold Absolute Pressure
$0C:	Engine RPM
$0D:	Vehicle Speed
$0E:	Ignition Timing Advance For #1 Cylinder
$0F:	Intake Air Temperature
$11:	Absolute Throttle Position
$12:	Commanded Secondary Air Status
$13:	Oxygen Sensor Bank 1 Sensor 1
$15:	Oxygen Sensor Bank 1 Sensor 2
$1C:	OBD Requirements To Which Vehicle Or Engine Is Certified
$1F:	Time Since Engine Start
$21:	Distance Driven With MIL On
$23:	Fuel Rail Pressure
$2E:	Commanded EVAP Purge
$2F:	Fuel Level
$30:	Warm Up Counts After Mil Erased
$31:	Distance Driven After Erasing DTC Memory
$33:	Barometric Pressure
$34:	Heater Current Bank 1 Sensor 1
$3C:	Calculated Catalyst Temperature
$41:	Monitor Status Current Drive Cycle
$42:	Control Module Voltage
$43:	Absolute Load Value
$44:	Specified Value Of Oxygen Sensor Signal
$45:	Relative Throttle Valve Position
$46:	Ambient Temperature
$47:	Throttle Valve Position 2 Absolute
$49:	Accelerator Pedal Position 1 Absolute
$4A:	Accelerator Pedal Position 2 Absolute
$4C:	Specified Throttle Valve Position
$51:	Fuel Type
$54:	EVAP System Vapor Pressure
$56:	Offset Oxygen Sensor Regulation After Catalytic Convertor
$5B:	Hybrid Battery Pack Remaining Charge
$6D:	Fuel Pressure Control System
$70:	Boost Control Pressure
$75:	Turbocharger Temperature
$77:	Charge Air Cooler Temperature

– Switch the ignition off.

3.3.2 Battery Regulation Control Module - J840- Diagnostic Mode 01 - Read Current System Data

Diagnostic Mode 01 makes it possible to access current emissions-related measured values and diagnostic data. The original measured values (no replacement values), input and output data and system status information are displayed using Diagnostic Mode 1.

Test requirement

- Coolant temperature at least 80° C.

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 1: Obtain data”.

– From the following table, select the desired the “PID” that is to be monitored, e.g. “PID $05 Coolant Temperature”.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
$04:	Calculated Load Value
$05:	Coolant Temperature
$0C:	Engine RPM
$0D:	Vehicle Speed
$41:	Monitor Status Current Drive Cycle
$42:	Control Module Voltage
$49:	Accelerator Pedal Position 1 Absolute

– Switch the ignition off.

3.3.3 Electrical Drive Control Module -J841- Diagnostic Mode 01 - Read Current System Data

Diagnostic Mode 01 makes it possible to access current emissions-related measured values and diagnostic data. The original measured values (no replacement values), input and output data and system status information are displayed using Diagnostic Mode 1.

Test requirement

- Coolant temperature at least 80° C.

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 1: Obtain data”.

– From the following table, select the desired the “PID” that is to be monitored, e.g. “PID $05 Coolant Temperature”.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
$04:	Calculated Load Value
$05:	Coolant Temperature
$0C:	Engine RPM
$0D:	Vehicle Speed
$11:	Absolute Throttle Position
$41:	Monitor Status Current Drive Cycle
$42:	Control Module Voltage
$43:	Absolute Load Value
$49:	Accelerator Pedal Position 1 Absolute

– Switch the ignition off.

3.3.4 Engine Control Module -J623- Diagnostic Mode 02 - Read Operating Conditions

When an emissions-related fault (pending DTC, visible in mode 07) is first detected, operating conditions are stored. Mode 02 makes it possible to access this freeze frame data as soon as this fault is shown in mode 03. Each control module only shows freeze frame data for one fault via mode 02. Therefore, there are two priority levels. If there is a malfunction with higher priority, the freeze frame data is overwritten.

– Fault with higher priority: Misfire malfunction or fuel trim malfunction.

– Fault with normal priority: All other emissions-related faults.

Note

Depending on scan tool and protocol used, the information in diagnostic mode 02 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

Note

If the engine does not start, crank the engine using starter for at least 5 seconds, do not switch the ignition off afterward.

– Select “Diagnostic Mode 2: Obtain data”.

– From the following table, select the desired the “PID”, e.g. “PID $05 Coolant Temperature” that is to be monitored.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
$02:	DTC Which Triggered Freeze Frame Data
$03:	Fuel System Status
$04:	Calculated Load Value
$05:	Coolant Temperature
$06:	Short Term Air Fuel Ratio
$07:	Long Term Air Fuel Ratio
$0B:	Intake Manifold Absolute Pressure
$0C:	Engine RPM
$0D:	Vehicle Speed
$0E:	Ignition Timing Advance For # 1 Cylinder
$0F:	Intake Air Temperature
$11:	Throttle Valve Position 1 Absolute
$12:	Commanded Secondary Air Status
$1F:	Time Since Engine Start
$23:	Fuel Rail Pressure
$2E:	Commanded EVAP Purge
$2F:	Fuel Level
$33:	Barometric Pressure
$42:	Control Module Voltage
$43:	Absolute Load Value
$44:	Commanded Equivalence Ratio
$45:	Relative Throttle Valve Position
$46:	Ambient Temperature
$47:	Throttle Valve Position 2 Absolute
$49:	Accelerator Pedal Position 1 Absolute
$4A:	Accelerator Pedal Position 2 Absolute
$4C:	Specified Throttle Valve Position
$51:	Type Of Fuel
$56:	Offset Oxygen Sensor Regulation After Catalytic Convertor
$5B:	Hybrid Battery Remaining Charge
$6D:	Fuel Pressure Control
$70:	Boost Pressure Control
$75:	Turbocharger Temperature
$77:	Charge Air Cooler Temperature

– Switch the ignition OFF.

3.3.5 Battery Regulation Control Module - J840- Diagnostic Mode 02 - Read Current System Data

Diagnostic Mode 01 makes it possible to access current emissions-related measured values and diagnostic data. The original measured values (no replacement values), input and output data and system status information are displayed using Diagnostic Mode 1.

Test requirement

- Coolant temperature at least 80° C.

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 1: Obtain data”.

– From the following table, select the desired the “PID” that is to be monitored, e.g. “PID $05 Coolant temperature”.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
$02:	DTC Which Triggered Freeze Frame Data
$04:	Calculated Load Value
$05:	Coolant Temperature
$0C:	Engine RPM
$0D:	Vehicle Speed
$1F:	Time Since Engine Start
$42:	Control Module Voltage
$43:	Absolute Load Value
$44:	Commanded Equivalence Ratio
$45:	Relative Throttle Valve Position
$49:	Accelerator Pedal Position 1 Absolute

– Switch the ignition off.

3.3.6 Electrical Drive Control Module -J841- Diagnostic Mode 02 - Read Current System Data

Diagnostic Mode 01 makes it possible to access current emissions-related measured values and diagnostic data. The original measured values (no replacement values), input and output data and system status information are displayed using Diagnostic Mode 1.

Test requirement

- Coolant temperature at least 80° C.

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 1: Obtain data”.

– From the following table, select the desired the “PID” that is to be monitored, e.g. “PID $05 Coolant Temperature”.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
$02:	DTC Which Triggered Freeze Frame Data
$04:	Calculated Load Value
$05:	Coolant Temperature
$0C:	Engine RPM
$0D:	Vehicle Speed

PID	Component or System
$1F:	Time Since Engine Start
$42:	Control Module Voltage
$43:	Absolute Load Value
$44:	Commanded Equivalence Ratio
$45:	Relative Throttle Valve Position
$49:	Accelerator Pedal Position 1 Absolute

– Switch the ignition off.

3.3.7 Diagnostic Mode 03 - Read DTC Memory

Diagnostic Mode 03 makes it possible to read emissions-related faults (confirmed DTC's: faults which have activated the MIL) in the ECM and in the TCM.

When the ECM recognizes an emissions-related fault in two consecutive drive cycles, it sends a request to the instrument cluster over the CAN to turn on the malfunction indicator lamp. If an electronic throttle malfunction is recognized, the ECM will send a request to the instrument cluster over the CAN to turn on the electronic power control warning lamp.

The DTCs are sorted by SAE code with the DTC tables consisting of a 5 digit alpha numeric value.

Note

Depending on scan tool and protocol used, diagnostic mode 03 and the information provided may be referred to by a different name.

The following tables provide a breakdown and explanation of the DTC code.

P-Codes

Component group					
P	x	x	x	x	DTC for the drivetrain
Norm-Code					
P	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts
P	1	x	x	x	Additional emission relevant DTCs provided by the manufacturer
P	2	x	x	x	DTCs defined by SAE with specified texts, from MY 2000
P	3	x	x	x	Additional emission relevant DTCs provided by the manufacturer from MY 2000

Component group					
Repair group					
P	x	0	x	x	Fuel and air mixture and additional emission regulations
P	x	1	x	x	Fuel and air ratios
P	x	2	x	x	Fuel and air ratios
P	x	3	x	x	Ignition system

P	x	4	x	x	Additional exhaust system
P	x	5	x	x	Speed and idle control
P	x	6	x	x	Control module and output signals
P	x	7	x	x	Transmission
P	x	8	x	x	Transmission
P	x	9	x	x	Control modules, input and output signals

U-Codes

Component group					
U	x	x	x	x	DTC for network (CAN bus)
Norm-Code					
U	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts

Procedure

– Connect the scan tool.
– Switch the ignition to the ON position.
– Select Diagnostic Mode 03: Interrogating fault memory.
– The stored DTC or DTC's will be displayed on the scan tool screen.

The following table is an example of the DTC information that may be displayed on the scan tool screen:

Indication example	Explanation
P0444	SAE Diagnostic Trouble Code
Evaporative emission canister purge regulator valve	Malfunctioning wiring path or malfunctioning component
Circuit open	Malfunction type as next

– Refer to the following DTC tables for the diagnostic repair procedures.

- ⇒ B3.5.1 attery Regulation Control Module, 2013-2014 MY", page 133
- ⇒ E3.6.1 lectrical Drive Control Module, 2013-2014 MYs", page 166
- ⇒ E3.4.1 ngine Control Module, 2013-2014 MY", page 43
- ⇒ T3.7.1 ransmission Mechatronic, DSG 7 speed 0CG (2013-2014 MY)", page 183

– Switch the ignition off.

3.3.8 Diagnostic Mode 04 - Erase DTC Memory

Diagnostic Mode 04 makes it possible to erase the DTC memory and to reset all emissions-related diagnostic data. In that way, all faults in the DTC memory in the ECM and TCM are erased. The adaptation values may also be reset.

Emissions-related diagnostic data includes (as applicable) :

- - MIL Status
- - Number of DTC's
- - Readiness bits
- - Confirmed DTC's
- - Pending DTC's
- - DTC that belongs to freeze frame
- - Freeze frame data
- - Test results of specific diagnostic functions
- - Distance driven with "MIL ON"
- - Number of warm-up cycles after erasing the DTC memory
- - Distance driven after erasing the DTC memory
- - Misfire counter

Note

Depending on scan tool and protocol used, diagnostic mode 04 and the information provided may be referred to by a different name.

Procedure

– Connect the scan tool.

– Switch the ignition on.

– Select Diagnostic Mode 03: Interrogating fault memory.

– Then select Mode 4: Reset/delete diagnostic data.

The scan tool will display "Diagnostic data being erased".

– Switch the ignition off.

3.3.9 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, 2013 – 2014 MY

Diagnostic Mode 06 makes it possible to retrieve test results for special components and systems which are continuously or not continuously monitored. If the diagnosis of a system is complete, the diagnostic result and the corresponding thresholds are saved and displayed in mode 06. This data remains saved (even with the ignition off) until either new diagnostic results become available or the DTC memory is erased.

The min & max values for each individual test in Mode 06 represent the minimum & maximum operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min & max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool company's development process.

For example; GST manual documentation will show the value as 0.3499 (units) while the scan tool will display the same value as 0.35 (units).

Depending on the scan tool and protocol used, the information displayed in Diagnostic Mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID),

On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and may be referenced by only a number.

Test requirements

- Exhaust system must be properly sealed between the catalytic converter and the cylinder heads.
- No DTCs stored in the DTC memory.
- Coolant temperature at least 80° C.

Work procedure

– Connect the scan tool.

– Start the engine and let run at idle speed.

– Select Mode 6: Check test the results of components that are not continuously monitored.

Select the desired Test-ID.

The current minimum and maximum values will be displayed on the scan tool screen.

The following table is a numerical list of all“Test-IDs” that may be selected.

Monitor-ID (Hex-ID)	Component or System
$01: ⇒ page 32	Oxygen Sensor Monitor Bank 1 - Sensor 1
$02: ⇒ page 33	Oxygen Sensor Monitor Bank 1 - Sensor 2
$21: ⇒ page 34	Catalytic Converter Monitoring
$35: ⇒ page 34	Camshaft Adjustment / VVT Bank 1
$3B: ⇒ page 35	Fuel Tank EVAP System Integrity / Leak Test (0.040" / 1.0 mm)
$3C: ⇒ page 35	Fuel Tank EVAP System Integrity / Leak Test (0.020" / 0.5 mm)
$3D: ⇒ page 35	EVAP Purge Valve Function Check
$41: ⇒ page 36	Oxygen Sensor Heater Monitor Bank 1 - Sensor 1
$42: ⇒ page 36	Oxygen Sensor Heater Monitor Bank 1 - Sensor 2
$71: ⇒ page 37	Secondary Air Monitor
$A2: ⇒ page 37	Mis-Fire Cylinder 1 Data
$A3: ⇒ page 38	Mis-Fire Cylinder 2 Data
$A4: ⇒ page 38	Mis-Fire Cylinder 3 Data
$A5: ⇒ page 39	Mis-Fire Cylinder 4 Data

Monitor-ID $01: Oxygen Sensor Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID $01”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$83	P0133	Oxygen Sensor Signal Dynamic Bank 1 - Sensor 1	0.250 V	1.99 V	Refer to DTC P0133 in the DTC summary table. ⇒ page 55 .

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$84	P2195	Oxygen Sensor Front / Rear Rationality Bank 1 - Sensor 1	-0.999 V	0.999 V	Refer to DTC P2195 in the DTC summary table. ⇒ page 108
$84	P2196	Oxygen Sensor Front / Rear Rationality Bank 1 - Sensor 1	-0.999 V	0.999 V	Refer to DTC P2196 in the DTC summary table. ⇒ page 108
$89	P0132	Oxygen Sensor Signal Dynamic Bank 1 - Sensor 1	–0.250 V	1.99 V	Refer to DTC P0132 in the DTC summary table. ⇒ page 54

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .

– Switch the ignition off.

Monitor-ID $02: Oxygen Sensor Monitor Bank 1- Sensor 2

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $02”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$05	P013A	Oxygen Sensor Transient Time Rich-Lean Bank 1 - Sensor 2	0.0 s	0.750 s	Refer to DTC P013A in the DTC summary table. ⇒ page 57 .
$06	P013B	Oxygen Sensor Transient Time Lean-Rich Bank 1 - Sensor 2	0.0 s	1.5 s	Refer to DTC P013B in the DTC summary table. ⇒ page 58 .
$93	P013E	Oxygen Sensor Delay Time Rich-Lean Bank 1 - Sensor 2	0.0 s	0.750 s	Refer to DTC P013E in the DTC summary table. ⇒ page 59 .
$94	P013F	Oxygen Sensor Delay Time Lean-Rich Bank 1 - Sensor 2	0.0 s	1.0 s	Refer to DTC P013F in the DTC summary table. ⇒ page 60 .
$95	P2270	Oxygen Sensor Maximum Oscillation Voltage Bank 1 - Sensor 2	0.859 V	7.999 V	Refer to DTC P2270 in the DTC summary table. ⇒ page 114
$96	P2271	Oxygen Sensor Minimum Oscillation Voltage Bank 1 - Sensor 2	0.0 V	0.2200 V	Refer to DTC P2271 in the DTC summary table. ⇒ page 115

– If any of the components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .

– Switch the ignition off.

Monitor-ID $21: Catalytic Converter Monitoring

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $21”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$84	P0420	Catalytic Converter Monitoring Bank 1.	100%	655.35%	Refer to DTC P0420 in the DTC summary table. ⇒ page 78 .

– If any of the components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .

– Switch the ignition off.

Monitor-ID $35: Camshaft Adjustment / VVT Bank 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $35”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$80	P0011	V V T Specified Intake Position Not Reached.	-28 – to 19 Deg.	-25 to 22 Deg.	Refer to DTC P0011 in the DTC summary table. ⇒ page 44
$81	P000A	V V T Specified Intake Position Is Reached Too Slow.	-28 – to 19 Deg.	-25 to 22 Deg.	Refer to DTC P000A in the DTC summary table. ⇒ page 43
$82	P0014	V V T Specified Exhaust Position Not Reached.	-25 to 12 Deg.	-22 to 15 Deg.	Refer to DTC P0014 in the DTC summary table. ⇒ page 44 .
$83	P000B	V V T Specified Exhaust Position Is Reached Too Slow.	-25 to 12 Deg.	-22 to 15 Deg.	Refer to DTC P000B in the DTC summary table. ⇒ page 43 .

– If any of the components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .

– Switch the ignition off.

Monitor-ID $3B: Fuel Tank EVAP System Integrity / Leak Test (0.040" / 1.0 mm)

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $3B”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$86	P0442	Fuel Tank Leak Test: Small leak.	900.0 Pa	8,191.75 Pa	Refer to DTC P0442 the DTC summary table. ⇒ page 81

– If any of the components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .

– Switch the ignition off.

Monitor-ID $3C: Fuel Tank EVAP System Integrity / Leak Test (0.020" / 0.5 mm)

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $3C”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$84	P0456	Tank Leak Test: Pinhole Leak (0.5 mm).	0.0 mm2	0.17 mm2	Refer to DTC P0456 in the DTC summary table. ⇒ page 84 .

– If any of the components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .

– Switch the ignition off.

Monitor-ID $3D: EVAP Purge Valve Function Check

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $3D”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$8C	P0496	Purge Flow Monitor Valve Open	0.0 mA	4.0 to 15.0 mA	Refer to DTC P0496 in the DTC summary table. ⇒ page 85
$8D	P0441	Purge Flow Monitor Valve Closed	0.0 mA	2.0 to 50.0 mA	Refer to DTC P0441 in the DTC summary table. ⇒ page 80 .
$8E	P04F0	Second Tank Ventilation Line Blocked	0.0 mA	0.0 to 60.0 mA	Refer to DTC P04F0 in the DTC summary table. ⇒ page 87 .

– If any of the components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .

– Switch the ignition off.

Monitor-ID $41: Oxygen Sensor Heater Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $41”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$85	P0135	Oxygen Sensor Heating In Front Of Catalytic Converter, Diagnosis, Bank 1 Sensor 1 Ceramic Temperature Monitoring.	640.0° C to 720° C	6513.5° C	Refer to DTC P0135 in the DTC summary table. ⇒ page 56 .

– If any of the components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .

– Switch the ignition OFF.

Monitor-ID $42: Oxygen Sensor Heater Monitor Bank 1 - Sensor 2

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $42”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$90	P0141	Oxygen Sensor Heating Between Catalytic Converter, Diagnosis, Bank 1 Sensor 2 Internal Resistance Test.	0.0 Ohms	4.56 to 1.20 k Ohms	Refer to DTC P0141 in the DTC summary table. ⇒ page 61 .

– If any of the components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .

– Switch the ignition off.

Monitor-ID $71: Secondary Air Monitor

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $71”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$82	P0491	Bank 1 Functional Check	0.102	1.999	Refer to DTC P0491 in the DTC summary table. ⇒ page 85 .
$85	P0410	Bank 1 Pressure Check	-32.768 kPa	0.500 kPa	Refer to DTC P0410 in the DTC summary table. ⇒ page 76
$8A	P2440	Bank 1 Leak Check	0.0	1.35	Refer to DTC P2440 in the DTC summary table. ⇒ page 121

– If any of the components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .

– Switch the ignition off.

Monitor-ID $A2: Mis-Fire Cylinder 1 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $A2”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0301	Misfire Cylinder 1, Average Value Over 10 Driving Cycles.	0 - 65,535 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 70 .

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0C	P0301	Misfire Cylinder 1, In This Driving Cycle.	0 - 65,535 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 70 .

– If any of the components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .
– Switch the ignition off.

Monitor-ID $A3: Mis-Fire Cylinder 2 Data

– Connect the scan tool.
– Start the engine and run at idle.
– Select “Mode 6 Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $A3:”.

– Select the desired “Test-ID” .
– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0302	Misfire Cylinder 2, Average Value Over 10 Driving Cycles.	0 - 65,535 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 71 .
$0C	P0302	Misfire Cylinder 2, In This Driving Cycle.	0 - 65,535 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 71 .

– If any of the components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .
– Switch the ignition off.

Monitor-ID $A4: Mis-Fire Cylinder 3 Data

– Connect the scan tool.
– Start the engine and run at idle.
– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $A4”.

– Select the desired “Test-ID” .
– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0303	Misfire Cylinder 3, Average Value Over 10 Driving Cycles.	0 - 65,535 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 72 .
$0C	P0303	Misfire Cylinder 3, In This Driving Cycle.	0 - 65,535 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 72 .

– If any of the components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.7 ode 03 - Read DTC Memory”, page 29 .

– Switch the ignition off.

Monitor-ID $A5: Mis-Fire Cylinder 4 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID $A5”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0304	Misfire Cylinder 4, Average Value Over 10 Driving Cycles.	0 - 65,535 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 73 .
$0C	P0304	Misfire Cylinder 4, In This Driving Cycle.	0 - 65,535 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 73 .

– Switch the ignition off.

3.3.10 Diagnostic Mode 07 - Read Faults Detected During the Current or Last Driving Cycle

Mode 07 makes it possible to check emissions-related faults which appeared during the current or last driving cycle (pending DTCs).

A pending DTC is saved the first time a fault is detected (output via Mode 07).

– If the fault is detected again by the end of the following driving cycle, a confirmed DTC is entered (output via Mode 03) and the MIL is activated.

– If this malfunction is not detected again by the end of the following driving cycle, the corresponding pending code will be deleted at the end of the driving cycle.

Note

Depending on scan tool and protocol used, some of the information provided may be referred to by a different name.

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

Note

If the engine does not start, crank the engine using starter for at least 5 seconds. Do not switch the ignition off afterward.

– Select Mode 7: Check test results of components that are continuously monitored.

The number of pending DTCs or 0 malfunctions detected will be displayed on the scan tool screen.

– Refer to the following DTC tables for the diagnostic repair procedures.

– Switch the ignition off.

◆ ⇒ E3.4.1 ngine Control Module, 2013-2014 MY", page 43

◆ ⇒ B3.5.1 attery Regulation Control Module, 2013-2014 MY", page 133

◆ ⇒ E3.6.1 lectrical Drive Control Module, 2013-2014 MYs", page 166

◆ ⇒ T3.7.1 ransmission Mechatronic, DSG 7 speed 0CG (2013-2014 MY)", page 183

3.3.11 Diagnostic Mode 08 - Request Control of On-Board System, Test or Component

Diagnostic Mode 08 is used to control the operation of an on-board system, test or component. A Mode 8 service can be used to turn on-board system ON or OFF, or to cycle an on-board system, test or component on or off for a specific period of time. The service can also be used to request system status or to report test results.

Test requirements

- No DTCs stored in the DTC memory.
- Intake Air Temperature (IAT) maximum 60° C.
- Coolant temperature 80° C - 110° C.
- Throttle valve angle 12.0% - 16.0%.

Function test

Mode 8 is Not supported for the DMTL leak detection system on this vehicle. Refer to the individual tests for EVAP codes or EVAP leak checking.

3.3.12 Diagnostic Mode 09 - Read Vehicle Information

Diagnostic Mode 09 makes it possible to access vehicle-specific information from the ECM and the TCM (where applicable).

Note

Depending on scan tool and protocol used, Diagnostic Mode 09 and the information provided may be referred to by a different name.

Test requirement

- No DTCs stored in the DTC memory.

Procedure

– Connect the scan tool.

– Switch the ignition on.

– Select Mode 09: Vehicle information.

– Select the desired Test-ID.

– The information requested will be displayed on the scan tool screen.

The following table is a numerical list of all Test-IDs that may be selected.

Test-ID	Diagnostic text
02:	Vehicle identification number e.g.
	♦ A different 17 digit number will be displayed for each vehicle
04:	Calibration identification e.g.
	♦ Engine Control Module (ECM)
	♦ Transmission Control Module (TCM)
06:	CVN (check sum) e.g.
	♦ EC5AE460 the check sum is different for every control module version
	♦ 000D105
08:	In-use Performance Tracking
0A:	ECU's/module's acronym and text name

– Switch the ignition off.

3.3.13 Diagnostic Mode 0A - Permanent Fault Codes

Note

- *The following is a generic explanation of the requirements, coverage, and operation of Mode 0A.*
- *Mode 0A may only be supported exclusively by OBD control modules in US vehicles. Mode 0A may not be supported in EOBD vehicles, meaning the control module may not send a response here.*

Mode 0A - Check Permanent DTC Memory (Request emissions-related diagnostic trouble codes with permanent status after code clear).

Permanent Fault Codes From MY 2010 with Phase-In conforming to CCR 1968.2 (d)(2.2.5): 50% from MY 2010 / 75% from MY 2011 / 100% from MY 2012. The vehicle only participates in Phase-In if all of the OBD-relevant control modules in the vehicle meet these requirements.

Mode 0A enables the request of all OBD-relevant faults with the status “Permanent Fault Code”.

- Permanent Fault Codes are Confirmed Fault Codes that are currently activating the MIL. That means faults that are still displayed in Mode 03 but no longer activate the MIL (History Fault Codes) are not Permanent Fault Codes.

- Permanent Fault Codes are updated in Mode 0A at the same time as NVRAM storage immediately after switching the ignition off. A newly detected Permanent Fault Code is only visible after switching the ignition off/on in Mode 0A.

- Permanent Fault Codes may only be erased in the control module after they are corrected as long as the last diagnostic result was a PASS, and the MIL is no longer activated by this fault. The Permanent Fault Codes should be erased from Mode 0A at the same time the MIL switches off when the ignition is switched off/on.

- Permanent Fault Codes may not be erased by clearing the DTC memory or disconnecting the power supply. Storage in NVRAM is required.

- Permanent Fault Codes may only be erased after clearing the DTC memory under the following conditions: - As long as no FAIL diagnostic result was detected for a Permanent Fault Code - and at least one PASS diagnostic result was detected - and the Minimum Trip Conditions for a General Denominator (without considering high/ambient temperature) were met in this phase in any DCY after erasing the DTC memory.

- The engine control module relays the message “Minimum Trip conditions met” to all other OBD control modules via CAN: CAN message OBD_01, Byte 8, Bit 4: OBD_Minimum_Trip.

- Permanent Fault Codes may NOT be erased if the diagnostic result is FAIL after clearing the DTC memory. A Pending Fault Code should be stored and the DTC memory line should be overwritten with new Freeze Frame data. (Exception: If the Pending Fault Code is corrected without a Confirmed Fault Code being detected, the Permanent Fault Code may also be erased under the conditions described below.)

- Permanent Fault Codes should be erased in engine control modules after Update Programming. At this time, all readiness bits (Mode 01 PID $01) must be reset to “not complete” [(g)(4.4.6)(D)]. Permanent Fault Codes should not be erased in OBD control modules with Comprehensive Components (CCM) as a single readiness bit if the identical program/data status is being programmed. If a different program/data status is being programmed, Permanent Fault Codes should be erased after Update Programming.

- The procedure in Mode 01 through Mode 09 and in the service tester is NOT affected by implementation of the Permanent Fault Codes.

Note

After MIL off during the 40 warm-up cycle self-healing process, the fault may not be reported as Permanent Fault Code anymore.

Procedure

- Erasing Permanent Fault Codes after code clear Service $0A – Permanent Fault Codes: can only be erased at the end of a driving cycle (during ECM keep alive time) if all the following conditions are fulfilled:
- ERASE: Permanent Fault Codes after code clear, the vehicle needs to be driven!

- NO FAIL: DTC cleared.
- MONITORS: PASS
- MINIMUM: Conditions fulfilled 600 s (cumulative) Engine running.
- DRIVE: 300 s (cumulative) vehicle speed > 25 mph (40 km/h)

3.4 Engine DTC Table

- ⇒ E3.4.1 ngine Control Module, 2013-2014 MY", page 43

3.4.1 Engine Control Module, 2013-2014 MY

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P000A "A" Camshaft Position Slow Response Bank 1	Intake Camshaft Position Slow Response Bank 1	• Difference between target vs. actual position > 12° – 40° CRK • For 3.0 s • And • Adjustment angle >= 2.5° CRK	• Time after engine start 5.0 – 300.0 s • Frequency 4 times • Oil temp -10° C – 110° C • Engine speed 800 – 6,000 RPM	• 9.0 s	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.8.4 amshaft Adjustment Valve 1 N205, Checking ", page 221 .
P000B "B" Camshaft Position Slow Response Bank 1	Exhaust Camshaft Position Slow Response Bank 1	• Difference between target vs. actual > 8° – 22° CRK • For 2.0 – 3.0 s • And • Adjustment angle >= 2.5° CRK	• Time after engine start 5.0 – 300.0 s • Frequency 4 times • Oil temp -10° C - 110° C • Engine speed 800 to 6,000 RPM	• 7.5 s	• 2 DCY	– Check the Exhaust Camshaft Adjustment Valve 1 -N318-. Refer to ⇒ E3.8.16 xhaust Camshaft Adjustment Valve 1 N318, Checking ", page 244 .
P0010 "A" Camshaft Position Actuator "A" Control Circuit/ Open Bank 1	Intake Camshaft Position Actuator Circuit Open Bank 1	• Signal voltage 4.70 V – 5.40 V	• Camshaft valve off • Engine speed > 80 RPM	• 0.5 s.	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.8.4 amshaft Adjustment Valve 1 N205, Checking ", page 221 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0011 "A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1	Intake Camshaft Position Timing - Over-Advanced Bank 1	• Adjustment angle < 2.5° CRK • Difference between target vs. actual position < 2.5° CRK	• Time after engine start 3.0 - 10.0 s. • Frequency 4 times • Oil temp -48° – 143° C • Engine speed 600 to 6,000 RPM	• 14.0 s .	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.8.4 amshaft Adjustment Valve 1 N205, Checking ", page 221 .
P0013 "B" Camshaft Position Actuator "A" Control Circuit/ Open Bank 1	Exhaust Camshaft Position Actuator Control Circuit Open	• Signal voltage 4.70 V to 5.40 V	• Camshaft valve commanded off • Engine speed > 80 RPM	• 0.5 s .	• 2 DCY	– Check the Exhaust Camshaft Adjustment Valve 1 -N318-. Refer to ⇒ E3.8.16 xhaust Camshaft Adjustment Valve 1 N318, Checking ", page 244 .
P0014 "B" Camshaft Position - Timing Over-Advanced or System Performance Bank 1	Exhaust Camshaft Position Timing - Over-Advanced Bank 1	• Difference between target vs. actual > 8° – 22° CRK • For 2.0 – 3.0 s • And • Adjustment angle >= 2.5° CRK	• Time after engine start 5 – 300 s • Frequency 4 times • Oil temp -10° – 110° C • Engine speed 800 - 6,000 RPM	• 7.5 s	• 2 DCY	– Check the Exhaust Camshaft Adjustment Valve 1 -N318-. Refer to ⇒ E3.8.16 xhaust Camshaft Adjustment Valve 1 N318, Checking ", page 244 .
P0016 Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A	Crankshaft Position to Intake Camshaft Position Correlation	• Permissable deviation < -15.01° • OR • > 15.01° CRK	---	• 20 rev	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.8.4 amshaft Adjustment Valve 1 N205, Checking ", page 221 . – Check the Engine Speed Sensor -G28-. Refer to ⇒ S3.8.39 peed Sensor, Checking", page 292 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0017 Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B	Crankshaft Position to Exhaust Camshaft Position Correlation	• Permissable deviation < -15.01° • OR • > 15.01° CRK	---	• 8.0 rev	• Multiple • 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.8.4 amshaft Adjustment Valve 1 N205, Checking ", page 221 . – Check the Engine Speed Sensor -G28-. Refer to ⇒ E3.8.13 ngine Speed Sensor G28, Checking", page 239
P0030 HO2S Heater Control Circuit Bank 1 Sensor 1	HO2S Heater Control Circuit Bank 1 Sensor 1	• Heater voltage 4.70 V – 5.40 V	• Time after engine start > 5.0 s • Heater commanded off	• 0.5 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .
P0031 HO2S Heater Control Circuit Low Bank 1 Sensor 1	HO2S Heater Control Circuit Low Bank 1 Sensor 1	• Heater voltage 0.0 V – 3.26 V	• Time after engine start > 5.0 s. • Heater commanded off	• 0.5 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .
P0032 HO2S Heater Control Circuit High Bank 1 Sensor 1	HO2S Heater Control Circuit High Bank 1 Sensor 1	• Heater current > 5.50 A	• Time after engine start > 5.0 s • Heater commanded off	• 0.5 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0033 Turbocharger/ Supercharger Bypass Valve "A" Control Circuit	Turbocharger Bypass Valve Control Circuit	• Actuator diagnostic signal failure or electrical error	---	• 0.5 s	• Continuous • 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.8.10 harge Air Pressure ActuatorV465 / Charge Air Pressure Actuator Position SensorG581, Checking", page 233 .
P0034 Turbocharger/ Supercharger Bypass Valve "A" Control Circuit Low	Turbocharger Bypass Valve Control Circuit Low	• Actuator diagnostic signal failure or electrical error	---	• 0.5 s	• Continuous • 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.8.10 harge Air Pressure ActuatorV465 / Charge Air Pressure Actuator Position SensorG581, Checking", page 233 .
P0035 Turbocharger/ Supercharger Bypass Valve "A" Control Circuit High	Turbocharger Bypass Valve Control Circuit High	• Actuator diagnostic signal failure or electrical error	---	• 0.5 s	• Continuous • 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.8.10 harge Air Pressure ActuatorV465 / Charge Air Pressure Actuator Position SensorG581, Checking", page 233 .
P0036 HO2S Heater Control Circuit Bank 1 Sensor 2	HO2S Heater Control Circuit Bank 1 Sensor 2	• Heater voltage, 2.34 V – 3.59 V	• Engine speed > 80 RPM • Heater, Commanded off	• 0.5 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0037 HO2S Heater Control Circuit Low Bank 1 Sensor 2	HO2S Heater Control Circuit Low Bank 1 Sensor 2	• Heater voltage < 2.34 V	• Engine speed > 80 RPM • Heater, Commanded off	• 0.5 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .
P0038 HO2S Heater Control Circuit High Bank 1 Sensor 2	HO2S Heater Control Circuit High Bank 1 Sensor 2	• Heater voltage > 3.59 V	• Engine speed > 80 RPM • Heater, Commanded on	• 0.5 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .
P0068 MAP/MAF - Throttle Position Correlation	MAP To Throttle Position Correlation	• Plausibility with fuel system • Load calculation < -22% • Plausibility with fuel system • Load calculation > 22%	• Engine speed 1,280 – 6,000 RPM • ECT > 63° C • IAT < 90° C • MAF, 0.0 – 300.0 kg/h • Load 20.0% – 100.0% • Fuel system monitor running • Lambda control closed loop	• 139.4 s	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.8.25 ntake Manifold SensorGX9, Checking", page 261 .
P006C MAP - Turbocharger/ Supercharger Inlet Pressure Correlation	MAP To Charge Pressure Sensor Correlation	• Difference of manifold pressure to average pressure value in front of throttle body > 20.0 kPa	• Desired boost pressure > 100 kPa – 511.99 kPa • Throttle position > 89.99% – 120% • Engine speed > 1,200 RPM	• 0.1 s	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.8.25 ntake Manifold SensorGX9, Checking", page 261 . – Check the Charge Air Pressure Sensor -GX26-. Refer to ⇒ C3.8.9 harge Air Pressure Sensor GX26, Checking", page 231 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P006D Barometric Pressure - Turbocharger/ Supercharger Inlet Pressure Correlation Bank 1	Barometric Pressure - Turbocharger/ Supercharger Inlet Pressure Correlation Bank 1	• Difference of ambient pressure to boost pressure value in front of throttle body > 15.0 kPa – 250.0 kPa	• Engine idling • Vehicle speed > 2 km/h • Throttle position > 0.0 – 7.01% • Engine speed 600 – 1,200 RPM • Catalyst heating not active	• 0.15 s	• 2 DCY	– Check the BARO pressure reading with a scan tool and compare it to the actual barometric pressure. If the reading is more than 10% off, replace the ECM (BARO sensor located inside). If the reading is within range: – Check the Charge Air Pressure Sensor - GX26-. Refer to ⇒ C3.8.9 harge Air Pressure Sensor GX26, Checking", page 231 .
P0070 Ambient Air Temperature Sensor Circuit "A"	Ambient Air Temperature Sensor Circuit	• Ambient air temperature < -50° C	• CAN active	• 6.0 s	• 2 DCY	– Refer to the appropriate electrical manual for proper diagnosis for the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.8.30 utside Air Temperature Sensor G17, Checking", page 271 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0071 Ambient Air Temperature Sensor Circuit "A" Range/ Performance	Ambient Air Temperature Sensor Performance	• Difference in value IAT vs. ECT at engine start (depending on engine off time) < 25.0 K • Difference in value IAT - AAT at engine start > 25.0 K (depending on engine off time)	• Engine off time > 5 hours • ECT at engine start < 2 K minus • ECT at time after engine start 60 s • AAT at engine start < 3 K minus • AAT at condition vehicle speed > 40 km/h for time > 10 s • IAT at engine start < 3 K minus • IAT at condition vehicle speed > 40 km/h for time > 10 s	• 0.0 s	• 2 DCY	– Refer to the appropriate electrical manual for proper diagnosis for the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.8.30 utside Air Temperature Sensor G17, Checking", page 271 .
P0072 Ambient Air Temperature Sensor Circuit "A" Low	Ambient Air Temperature Sensor Circuit Low	• Ambient air temperature > 77° C	• CAN active	• 6.0 s	• 2 DCY	– Refer to the appropriate electrical manual for proper diagnosis for the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.8.30 utside Air Temperature Sensor G17, Checking", page 271 .
P007B Charge Air Cooler Temperature Sensor Circuit Range/ Performance Bank 1	Charge Air Cooler Temperature Sensor Circuit Performance	• Difference of IAT at start vs. ECT at start < -24.8° or > 24.8° Kelvin • OR • Difference of IAT at start vs. charge air cooler temp sensor at start < -24.8° or > 24.8° Kelvin	• Cross check of ECT vs. IAT vs. AAT finished	• 0.0 s	• Once • 2 DCY	– Check the Charge Air Pressure Sensor -GX26-. Refer to ⇒ C3.8.9 harge Air Pressure Sensor GX26, Checking", page 231 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P007C Charge Air Cooler Temperature Sensor Circuit Low Bank 1	Charge Air Cooler Temperature Sensor Circuit Low	• Signal voltage < 0.22 V	• Ratio commanded boost pressure and ambient pressure <= 1.60 • Engine speed <= 1,520 RPM for > 120 s	• 1.0 s	• Continuous • 2 DCY	– Check the Charge Air Pressure Sensor - GX26-. Refer to ⇒ C3.8.9 harge Air Pressure Sensor GX26, Checking", page 231 .
P007D Charge Air Cooler Temperature Sensor Circuit High Bank 1	Charge Air Cooler Temperature Sensor Circuit High	• Signal voltage > 4.85 V	• ECT >= 0.0 °C • Vehicle speed <= 100 km/h • MAF <= 92kg/h for > 10 s	• 1.0 s	• Continuous • 2 DCY	– Check the Charge Air Pressure Sensor - GX26-. Refer to ⇒ C3.8.9 harge Air Pressure Sensor GX26, Checking", page 231 .
P0087 Fuel Rail/ System Pressure - Too Low Bank 1	Fuel Rail/ System Pressure - Too Low Bank 1	• Fuel trim activity 1.3 – 0.16 • Output value rail pressure control activity > 2.0 MPa • Difference between target and actual pressure > -16.4	• Engine speed > 800 RPM • EVAP purge adaptation < 22 • Lambda control closed loop	• 5.0 s	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ page 20 and/or to appropriate repair manual. If the fuel pressure is out of range: – Check the Fuel Pressure Regulator Valve - N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 . If the fuel pressure is Not out of range: – Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.8.21 uel Pressure SensorG247, Checking", page 254 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P00AF Turbocharger/ Supercharger Boost Control "A" Module Performance	Turbocharger Boost Control Module Performance	• Difference between target and actual position < -12% • OR • > 12%	• Engine running • Position sensor from maximum range < 70% • OR • > 70%	• 1.0 s .	• Continuous • 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.8.10 harge Air Pressure ActuatorV465 / Charge Air Pressure Actuator Position SensorG581, Checking", page 233 .
P0106 Manifold Absolute Pressure/ Barometric Pressure Sensor Circuit Range/ Performance	Manifold Absolute Pressure/ Barometric Pressure Circuit Performance	• Difference of boost pressure signal vs altitude sensor signal > 230 hPa OR • Difference of boost pressure signal vs altitude sensor signal < -130 hPa	• Engine speed < 1,000 RPM • Throttle position < 11.50%	• 2.0 s	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.8.25 ntake Manifold SensorGX9, Checking", page 261 . – If there is no fault found with the Manifold Absolute Pressure sensor or wiring, check for any related TSB's. The altitude sensor is located within the ECM and will require replacement of the ECM if the scan tool reading is more than 10% off of actual Barometric pressure. Refer to the Repair Manual for ECM replacement.
P0106 Manifold Absolute Pressure/ Barometric Pressure Sensor Circuit Range/ Performance	Manifold Absolute Pressure/ Barometric Pressure Circuit Performance	• Difference of manifold pressure to average value of all pressure sensors < -3.70 • OR • > 3.70 kPa	• Engine shutoff time > 6.0 s	• 0.0 s	• Continuous • 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.8.25 ntake Manifold SensorGX9, Checking", page 261 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0107 Manifold Absolute Pressure/ Barometric Pressure Sensor Circuit Low	Manifold Absolute Pressure/ Barometric Pressure Circuit Low	• Signal voltage < 2.0 V • OR • manifold pressure signal < 10 kPa	---	• 1.0 s	• Continuous • 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.8.25 ntake Manifold SensorGX9, Checking", page 261 .
P0108 Manifold Absolute Pressure/ Barometric Pressure Sensor Circuit High	Manifold Absolute Pressure/ Barometric Pressure Circuit High	• Signal voltage > 4.8 V • OR • manifold pressure signal > 370 kPa	---	• .01 s	• Continuous • 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.8.25 ntake Manifold SensorGX9, Checking", page 261 .
P0111 Intake Air Temperature Sensor 1 Circuit Range/ Performance Bank 1	Intake Air Temperature Sensor 1 Circuit Range/ Performance	• Difference in value IAT vs. ECT at engine start (depending on engine off time) > 25 K • Difference in value IAT - AAT at engine start < 25 K (depending on engine off time)	• Engine off time > 5.0 hours • ECT at engine start < 2 K minus • ECT at time after engine start 60 s • AAT at engine start < 3 K minus • AAT at condition vehicle speed > 40 km/h for time > 10 s • IAT at engine start < 3 K minus • IAT at condition vehicle speed > 40 km/h for time > 10 s	• 0.0 s	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.8.25 ntake Manifold SensorGX9, Checking", page 261 .
P0112 Intake Air Temperature Sensor 1 Circuit Low Bank 1	Intake Air Temperature Sensor 1 Circuit Low Input	• IAT > 141.0° C	---	• 2.0 s	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.8.25 ntake Manifold SensorGX9, Checking", page 261 .
P0113 Intake Air Temperature Sensor 1 Circuit High Bank 1	Intake Air Temperature Sensor 1 Circuit High Input	• IAT < -46° C	---	• 2.0 s	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.8.25 ntake Manifold SensorGX9, Checking", page 261 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0116 Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	Engine Coolant Temperature Sensor 1 Circuit Performance	• Difference in value IAT vs. ECT at engine start (depending on engine off time) > 25 K • Difference in value IAT - AAT at engine start < 25 K (depending on engine off time)	• Engine off time > 5.0 hours • ECT at engine start < 2 K minus • ECT at time after engine start 60 s. • AAT at engine start < 3 K minus • AAT at condition veh speed > 40 km/h for time > 10 s • IAT at engine start < 3 K minus • IAT at condition vehicle speed > 40 km/h for time > 10 s.	• 0.0 s	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.8.11 ngine Coolant Temperature SensorG62, Checking”, page 235 .
P0117 Engine Coolant Temperature Sensor 1 Circuit Low	Engine Coolant Temperature Sensor 1 Circuit Low Input	• ECT >140° C	---	• 2.0 s	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.8.11 ngine Coolant Temperature SensorG62, Checking”, page 235 .
P0118 Engine Coolant Temperature Sensor 1 Circuit High	Engine Coolant Temperature Sensor 1 Circuit High Input	• ECT < -40° C	---	• 2.0 s	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.8.11 ngine Coolant Temperature SensorG62, Checking”, page 235 .
P0121 Throttle/ Pedal Position Sensor/ Switch "A" Circuit Range/ Performance	Accelerator Pedal Position Sensor Circuit Range/ Performance	• TPS 1 - TPS 2 > 6.30% • Actual TPS 1 calculated value > TPS 2 calculated value • TPS 1 calc. value > 9.00%	• Engine speed > 480 RPM	• 0.3 s	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking”, page 289 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0122 Throttle/ Pedal Position Sensor/ Switch "A" Circuit Low	Accelerator Pedal Position Sensor Circuit Low Input	• Signal voltage < 0.20 V	---	• 0.1 s	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking", page 289 .
P0123 Throttle/ Pedal Position Sensor/ Switch "A" Circuit High	Accelerator Pedal Position Sensor Circuit High Input	• Signal voltage > 4.81 V	---	• 0.1 s	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking", page 289 .
P0130 O2 Sensor Circuit Bank 1 Sensor 1	O2 Sensor Circuit Bank 1, Sensor 1	• O2S ceramic temp. < 640° C	• Modeled exhaust temp > 300° C • Fuel cutoff not active	• 12.0 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .
P0131 O2 Sensor Circuit Low Voltage Bank 1 Sensor 1	O2 Sensor Circuit, Bank 1 - Sensor 1 Low Voltage	• VM > 1.75 V • UN > 1.50 V • IA or IP > 0.30 V	---	• 10.0 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .
P0132 O2 Sensor Circuit High Voltage Bank 1 Sensor 1	O2 Sensor Circuit, Bank 1 - Sensor 1 High Voltage	• VM > 3.25 V • UN > 4.40 V • IA or IP > 7.0 V	---	• 10.0 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0133 O2 Sensor Circuit Slow Response Bank 1 Sensor 1	O2 Circuit Slow Response Bank 1 Sensor 1	• Signal dynamic slope check • O2S signal front vs. modeled O2S signal ratio < 0.35 and > 0.01 • Cycles completed > 5.0 • Oscillation check • Lambda amplitude signal > 20% • Cycles > 5.0 • Time lambda > lambda amplitude 400 ms • Delay check • Delay modeled lambda signal minus measured signal > 460 ms. • Cycles > 12.0	• Engine speed 1,200 – 3,200 RPM • Engine load, 25.0% – 110.0% • Delta engine load < = 7.99% • Actual lambda, 0.85 – 1.15 • Lambda control, Closed loop • EVAP purge flow < 18.0 - • Determination of max. and min. slope ratios 0.01 – 4.0 • O2S hexagon modeled temp < 569.99° C • O2S ceramic temp > 715° C • Determination of measurement window, 500 ms. Oscillation and delay check • Lambda control, Closed loop • Engine load 20% – 80% • Engine speed 1,340 – 3,500 RPM • Delta engine load < 3% • Actual lambda 0.75 – 1.25	• 400.0 s Oscillation and delay check • 125.0 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0135 O2 Sensor Heater Circuit Bank 1 Sensor 1	O2 Heater Circuit Bank 1 Sensor 1	• Heater duty cycle, > 90% • O2S ceramic temperature, < 715° C • Time after O2S heater on 40 s	• Heater control, Active • Modeled exhaust gas temp, > 300° C • ECT at start > -11° C • Engine shutoff time > 300 s • Heater commanded on • Number of checks > 10	• 40 - 55 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .
P0136 O2 Sensor Circ. Bank 1 - Sensor 2 Malfunction	O2 Sensor Circuit Bank 1 Sensor 2	• Delta voltage one step at heater switching > 2.00 V • Number of checks 4.0	• Sensor voltage <= 0.40 V • Modeled exhaust gas temp. >= 700° C for 10 s	• 40 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .
P0137 O2 Sensor Circuit Low Voltage Bank 1 Sensor 2	O2 Sensor Circuit Low Voltage Bank 1 Sensor 2	Cold condition • Signal voltage, < 0.06 V Warm condition • Signal voltage < 59.6 mv • Reaction at closed loop enrichment - no reaction	• Sensor voltage <= 0.40 V OR • Sensor voltage 0.50 – 1.08 V • Exhaust temp >= 650° C for 10 s OR • Heater power >= 50% for > 10 s	• 3.0 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .
P0138 O2 Sensor Circuit High Voltage Bank 1 Sensor 2	O2 Sensor Circuit High Voltage Bank 1 Sensor 2	• Signal voltage 1.08 V for > 5.0 s.	• Sensor voltage <= 0.40 V OR • Sensor voltage 0.50 – 1.08 V • Exhaust temp >= 650° C for 10 s OR • Heater power >= 50% for > 10 s	• 5.0 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0139 O2 Sensor Circ. Bank 1 - Sensor 2 Slow Response	O2 Sensor Circuit Slow Response Bank 1 Sensor 2	• EWMA filtered transient time at fuel cutoff > 1.2 s • In voltage range of 201 - 401 mV • Number of checks, 3.0	• Rich voltage enable > = 547.9 mV • Lean voltage < = 201.2 mV • Fuel cutoff active • O2S rear ready • Modeled exhaust gas temp > 400° C • Front O2 sensor lambda signal > 2.00 V	• 100 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .
P013A O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	O2 Sensor Slow Response Rich to Lean Bank 1 Sensor 2	• EWMA filtered max differential transient time at fuel cutoff >= 5.0 s and number of checks >= 3.0	• Time of fuel cutoff <= 90 s. • Time after last cutoff >= 20 s • O2S rear ready • Exhaust temp at sensor >= 450° C • Difference between expected and measured front O2 signal < 6.0 • After time since first cylinder fuel cutoff >= 1.4 s. • Oscillation check ready • Exhaust mass flow >= 12.0 kg/h • Sensor voltage at start of measurement > 0.55 V • Target voltage at end of measurement <= 0.15 V	• 10 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P013B O2 Sensor Slow Response - Lean to Rich Bank 1 Sensor 2	O2 Sensor Slow Response Lean To Rich Bank 1 Sensor 2	• EWMA filtered max differential transient time at fuel feed restart and number of checks >= 1.0	• Time of fuel cutoff <= 90 s. • Time after last cutoff >= 20 s • O2S rear ready • Exhaust temp at sensor >= 450° C • Difference between expected and measured front O2 signal < 6.0 • After time since first cylinder fuel cutoff >= 1.4 s. • Oscillation check ready • Exhaust mass flow >= 12.0 kg/h • Sensor voltage at start of measurement > 0.55 V • Target voltage at end of measurement <= 0.15 V	• 10 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P013E O2 Sensor Delayed Response - Rich to Lean Bank 1 Sensor 2	O2 Sensor Delayed Response Rich to Lean Bank 1 Sensor 2	• EWMA filtered max differential transient time at fuel cutoff >= 5.0 s and number of checks >= 3.0	• Time of fuel cutoff <= 90 s. • Time after last cutoff >= 20 s • O2S rear ready • Exhaust temp at sensor >= 450° C • Difference between expected and measured front O2 signal < 6.0 • After time since first cylinder fuel cutoff >= 1.4 s. • Oscillation check ready • Exhaust mass flow >= 12.0 kg/h • Sensor voltage at start of measurement > 0.55 V • Target voltage at end of measurement <= 0.15 V	• 40 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P013F O2 Sensor Delayed Response - Lean to Rich Bank 1 Sensor 2	O2 Sensor Delayed Response Lean To Rich Bank 1 Sensor 2	• EWMA filtered max differential transient time at fuel feed restart and number of checks >= 1.0	• Time of fuel cut-off <= 90 s • Time after last cutoff >= 20 s • O2S rear ready • Exhaust temp at sensor >= 450° C • Difference between expected and measured front O2 signal < 6.0 • After time since first cylinder fuel cutoff >= 1.4 s • Oscillation check ready • Exhaust mass flow >= 12.0 kg/h • Sensor voltage at start of measurement > 0.55 V • Target voltage at end of measurement <= 0.15 V	• 40 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .
P0140 O2 Sensor Circuit No Activity Detected Bank 1 Sensor 2	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 2	• Signal voltage • Signal voltage 0.40 – 0.60 mV for > 3 s. • Internal resistance • > 40,000 ohm	• Signal voltage • Sensor voltage <= 0.40 V • Internal resist • Exhaust gas temp. 650° C for > 10 s • Heater power >= 50% for > 10 s • Dew-point exceeded > 10.0 times	• 30 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0141 O2 Sensor Heater Circuit Bank 1 Sensor 2	O2 Sensor Heater Circuit Bank 1 Sensor 2	• Heater resistance, 792 to 4,560 Ohm	• Heater commanded on • Modeled exhaust gas temp, 250° - 650° C • Engine shutoff time > 60 s • Fuel cutoff not active • No. of checks = 10.0	• 15 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .
P0169 Incorrect Fuel Composition	Incorrect Fuel Composition	• Fuel quantity incorrect • Fuel correction factor incorrect • Internal check failed	• Engine speed > 1,200 RPM	• 0.5 - 2.08 s .	• 2 DCY	– Check for contaminated/aged fuel or possible high concentration of alcohol in fuel (above 15%). Poor quality fuel will also increase consumption. Replace with fresh fuel if contaminated.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0171 System Too Lean Bank 1	System Too Lean Bank 1	• At idle • Adaptive value > 5.02% At part load • Adaptive value > 21%	• At idle • Engine speed, 560 – 1,200 RPM • Engine load, 9% – 45% • Mass air flow 5 – 23 kg/h • ECT > 63° C • IAT < 90° C • Part load adaptation ready • Lambda control, Closed loop • EVAP purge valve, Closed • No low fuel signal At part load • Throttle position < 99.6% • Engine speed 1,320 – 5,000 RPM • Engine load 20.0 – 100% • Mass air flow 27.0 – 450 kg/h • ECT > 63° C • IAT < 90° C • Lambda control closed loop • EVAP purge valve closed • No low fuel signal	• 10 s	• 2 DCY	– Check the intake system for leaks (air bypassing the MAF) . – Check the vacuum lines for leaks. – If the Fuel Pressure is OK: check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 . – If the fuel pressure is out of range: check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 . – Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0172 System Too Rich Bank 1	System Too Rich Bank 1	• At idle • Adaptive value < -5.02% At part load • Adaptive value < -21%	• At idle • Engine speed, 560 – 1,200 RPM • Engine load, 9% – 45% • Mass air flow 5 – 23 kg/h • ECT > 63° C • IAT < 90° C • Part load adaptation ready • Lambda control, Closed loop • EVAP purge valve, Closed • No low fuel signal • At part load • Throttle position < 99.6% • Engine speed 1,320 – 5,000 RPM • Engine load 20% – 100% • Mass air flow 27 – 450 kg/h • ECT > 63° C • IAT < 90° C • Lambda control closed loop • EVAP purge valve closed • No low fuel signal	• 10 s	• 2 DCY	– If the Fuel Pressure is OK: check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking”, page 250 . – If the fuel pressure is out of range: check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking”, page 252 . – If the fuel pressure is Not out of range: check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking”, page 250 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking”, page 276 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.8.14 VAP Canister Purge Regulator Valve 1 N80, Checking”, page 240 .
P0190 Fuel Pressure Regulator "A" Control Circuit/Open	Fuel Rail Pressure Sensor Circuit	• Signal voltage > 4.8 V	---	• 0.5 s	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.8.21 uel Pressure SensorG247, Checking”, page 254 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0191 Fuel Rail Pressure Sensor Circuit Range/ Performance Bank 1	Fuel Rail Pressure Sensor Circuit Range/ Performance	• Actual pressure > 20.6 MPa	• Time after engine start > 0.0 s. • Engine speed > 90 RPM	• 3.0 s	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.8.21 uel Pressure SensorG247, Checking", page 254 .
P0192 Fuel Rail Pressure Sensor Circuit Low Bank 1	Fuel Rail Pressure Sensor Circuit Low Input	• Signal voltage < 0.2 V	---	• 0.5 s	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.8.21 uel Pressure SensorG247, Checking", page 254 .
P0201 Cylinder 1 Injector "A" Circuit	Injector Circuit Open Cylinder 1	• Low side signal current < 2.1 A • Internal logic failure	• Engine speed, > 80 RPM • Injection valve switched on	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .
P0202 Cylinder 2 Injector "A" Circuit	Injector Circuit Open Cylinder 2	• Low side signal current < 2.1 A • Internal logic failure	• Engine speed, > 80 RPM • Injection valve switched on	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .
P0203 Cylinder 3 Injector "A" Circuit	Injector Circuit Open Cylinder 3	• Low side signal current < 2.1 A • Internal logic failure	• Engine speed, > 80 RPM • Injection valve switched on	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .
P0204 Cylinder 4 Injector "A" Circuit	Injector Circuit Open Cylinder 4	• Low side signal current < 2.1 A • Internal logic failure	• Engine speed, > 80 RPM • Injection valve switched on	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .
P0221 Throttle/ Pedal Position Sensor/ Switch "B" Circuit Range/ Performance	Accelerator Pedal Position Sensor Circuit Range/ Performance	• TPS 1 - TPS 2 > 6.30% • Actual TPS 2 calculated value > TPS 1 calculated value • TPS 2 – calc. value > 9.00%	• Engine speed > 480 RPM	• 0.3 s	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking", page 289 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0222 Throttle/ Pedal Position Sensor/ Switch "B" Circuit Low	Accelerator Pedal Position Sensor Circuit Low Input	• Signal voltage < 0.20 V	---	• 0.1 s	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking", page 289 .
P0223 Throttle/ Pedal Position Sensor/ Switch "B" Circuit High	Accelerator Pedal Position Sensor Circuit High Input	• Signal voltage > 4.81 V	---	• 0.1 s	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking", page 289 .
P0234 Turbocharger/ Supercharger "A" Overboost Condition	Turbocharger Overboost Condition	• Difference of set value boost pressure vs. actual boost sensor signal > 260 – 1,275 hPa	• Altitude < 2,700 m	• 1.2 s	• 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.8.10 harge Air Pressure ActuatorV465 / Charge Air Pressure Actuator Position SensorG581, Checking", page 233 . – Check the Charge Air Pressure Sensor -GX26-. Refer to ⇒ C3.8.9 harge Air Pressure Sensor GX26, Checking", page 231 .
P0236 Manifold Absolute Pressure/ Barometric Pressure Sensor Circuit Range/ Performance	Turbocharger Boost Sensor Circuit Range/ Performance	• Difference of set value boost pressure vs altitude sensor signal > 230 • And • < -130 hPa	• Engine speed < 1,000 RPM • Throttle position < 6.81%	• 2 s	• 2 DCY	– Check the Charge Air Pressure Sensor -GX26-. Refer to ⇒ C3.8.9 harge Air Pressure Sensor GX26, Checking", page 231 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0237 Turbocharger/ Supercharger Boost Sensor "A" Circuit Low	Turbocharger Boost Sensor Circuit Low	• Signal voltage < 0.2 V	---	• 0.5 s	• 2 DCY	– Check the Charge Air Pressure Sensor - GX26-. Refer to ⇒ C3.8.9 harge Air Pressure Sensor GX26, Checking", page 231 .
P0238 Turbocharger/ Supercharger Boost Sensor "A" Circuit High	Turbocharger Boost Sensor A Circuit High	• Signal voltage > 4.88 V	---	• 0.5 s	• 2 DCY	– Check the Charge Air Pressure Sensor - GX26-. Refer to ⇒ C3.8.9 harge Air Pressure Sensor GX26, Checking", page 231 .
P023A Charge Air Cooler Coolant Pump "A" Control Circuit/Open	Charge Air Cooler Coolant Pump Control Circuit Open	• Signal voltage 4.8 – 5.3 V	• Ignition on	• 0.5 s	• Continuous • 2 DCY	– Check the Low Temperature Coolant Pump - V468-. Refer to ⇒ L3.8.28 ow Temperature Circuit Coolant Pump V468, Checking ", page 267
P023C Charge Air Cooler Coolant Pump "A" Control Circuit High	Charge Air Cooler Coolant Pump Control Circuit High	• Signal current > 2.2 – 4.0 A	• Ignition on	• 0.5 s	• Continuous • 2 DCY	– Check the Low Temperature Coolant Pump - V468-. Refer to ⇒ L3.8.28 ow Temperature Circuit Coolant Pump V468, Checking ", page 267 .
P025A Fuel Pump Module "A" Control Circuit/Open	Fuel Pump Module Control Circuit Open	• Signal voltage > 4.40 V – 5.60 V	• Engine speed, > 80 RPM • Battery voltage, 9.04 – 16.0 V	• 0.5 s	• 2 DCY	– Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.8.17 uel Delivery UnitGX1 / Fuel Pump Control Module J538, Testing", page 246 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P025C Fuel Pump Module "A" Control Circuit Low	Fuel Pump Module Control Circuit Low	• Signal voltage < 2.15 V – 3.25 V	• Engine speed, > 80 RPM • Battery voltage, 9.04 – 16.0 V	• 0.5 s	• 2 DCY	– Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.8.17 uel Delivery UnitGX1 / Fuel Pump Control Module J538, Testing", page 246 .
P025D Fuel Pump Module "A" Control Circuit High	Fuel Pump Module Control Circuit High	• Signal current > 1.1 A	• Engine speed, > 80 RPM • Battery voltage, 9.04 – 16.0 V	• 0.5 s	• 2 DCY	– Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.8.17 uel Delivery UnitGX1 / Fuel Pump Control Module J538, Testing", page 246 .
P0261 Cylinder 1 Injector "A" Circuit Low	Cylinder 1 Injector Circuit Low	• Signal current < 2.1 A	• Injection valve, Commanded on • Engine speed, > 80 RPM • High side signal current, > 4.20 A	• 0.5 s	• 2 DCY Actual TPS 2 calculated value > TPS 1 calculated value	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .
P0262 Cylinder 1 Injector "A" Circuit High	Cylinder 1 Injector Circuit High	• Signal current > 14.70 A	• Injection valve, Commanded on • Engine speed, > 80 RPM	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .
P0264 Cylinder 2 Injector "A" Circuit Low	Cylinder 2 Injector Circuit Low	• Signal current < 2.1 A	• Injection valve, Commanded on • Engine speed, > 80 RPM • High side signal current, > 4.20 A	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .
P0265 Cylinder 2 Injector "A" Circuit High	Cylinder 2 Injector Circuit High	• Signal current > 14.70 A	• Injection valve, Commanded on • Engine speed, > 80 RPM	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0267 Cylinder 3 Injector "A" Circuit Low	Cylinder 3 Injector Circuit Low	• Signal current < 2.1 A	• Injection valve, Commanded on • Engine speed, > 80 RPM • High side signal current, > 4.20 A	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .
P0268 Cylinder 3 Injector "A" Circuit High	Cylinder 3 Injector Circuit High	• Signal current > 14.70 A	• Injection valve, Commanded on • Engine speed, > 80 RPM	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .
P0270 Cylinder 4 Injector "A" Circuit Low	Cylinder 4 Injector Circuit Low	• Low side signal current < 2.1 A	• Injection valve, Commanded on • Engine speed, > 80 RPM • High side signal current, > 4.20 A	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .
P0271 Cylinder 4 Injector "A" Circuit High	Cylinder 4 Injector Circuit High	• Signal current > 14.70 A	• Injection valve, Commanded on • Engine speed, > 80 RPM	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .
P0299 Turbocharger/ Supercharger "A" Underboost Condition	Turbocharger Underboost	• Difference of set boost pressure vs actual boost pressure value > 150 hPa	• Engine speed > 2,800 RPM • Altitude < 2,700 m • Difference of set value boost pressure vs basic boost pressure value > 250 hPa • Boost pressure control active • Turbo charger bypass valve closed	• 6.0 s	• 2 DCY	– Check the charge air system for proper seal. Refer to the Repair Manual. – Check the Charge Air Pressure Sensor - GX26-. Refer to ⇒ C3.8.9 harge Air Pressure Sensor GX26, Checking", page 231 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0300 Random/ Multiple Cylinder Misfire Detected	Random Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.5% • Catalyst damage misfire rate (MR), > 5.75% – 22.25%	• ECT, >= -11° C • Active after engine start, Idle - 150 RPM • Engine torque, >= 0.0 Nm • Camshaft revolutions 1.0 • Rough road not detected • Fuel cutoff Not active	• 1,000 rev • 200 rev	• 2 DCY • Immediate	– If a fuel system lean code is also set, perform diagnostics for that code first. – Check the spark plugs visually. – Check the intake system visually for leaks (false air) and check for an engine mechanical fault with a cylinder compression test. Refer to appropriate repair manual. – Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ C3.1 heck ", page 19 and/or to appropriate repair manual. – If the fuel pressure is out of range: check the Fuel Pressure Regulator Valve - N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 . – If the fuel pressure is Not out of range: check Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 . – Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0301 Cylinder 1 Misfire Detected	Cylinder 1 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.5% • Catalyst damage misfire rate (MR), > 5.75% – 22.25%	• ECT, >= -11° C • Active after engine start, Idle - 150 RPM • Engine torque, >= 0.0 Nm • Camshaft revolutions 1.0 • Rough road not detected • Fuel cutoff Not active	• 1,000 rev • 200 rev	• 2 DCY • Immed.	– If a fuel system lean code is also set, perform diagnostics for that code first. – Check the spark plugs visually. – Check the intake system visually for leaks (false air) and check for an engine mechanical fault with a cylinder compression test. Refer to appropriate repair manual. – Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 . – Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0302 Cylinder 2 Misfire Detected	Cylinder 2 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.5% • Catalyst damage misfire rate (MR), > 5.75% – 22.25%	• ECT, >= -11° C • Active after engine start, Idle - 150 RPM • Engine torque, >= 0.0 Nm • Camshaft revolutions 1.0 • Rough road not detected • Fuel cutoff Not active	• 1,000 rev • 200 rev	• 2 DCY • Immed.	– If a fuel system lean code is also set, perform diagnostics for that code first. – Check the spark plugs visually. – Check the intake system visually for leaks (false air) and check for an engine mechanical fault with a cylinder compression test. Refer to appropriate repair manual. – Check the Ignition Coils with Power Output Stage. Refer to ⇒ 13.8.24 gnition Coils with Power Output Stage, Checking", page 259 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0303 Cylinder 3 Misfire Detected	Cylinder 3 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.5% • Catalyst damage misfire rate (MR), > 5.75% – 22.25%	• ECT, >= -11° C • Active after engine start, Idle - 150 RPM • Engine torque, >= 0.0 Nm • Camshaft revolutions 1 • Rough road not detected • Fuel cutoff Not active	• 1,000 rev • 200 rev	• 2 DCY • Immed.	– If a fuel system lean code is also set, perform diagnostics for that code first. – Check the spark plugs visually. – Check the intake system visually for leaks (false air) and check for an engine mechanical fault with a cylinder compression test. Refer to appropriate repair manual. – Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 . – Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0304 Cylinder 4 Misfire Detected	Cylinder 4 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.5% • Catalyst damage misfire rate (MR), > 5.75% – 22.25%	• ECT, >= -11° C • Active after engine start, Idle - 150 RPM • Engine torque, >= 0.0 Nm • Camshaft revolutions 1.0 • Rough road not detected • Fuel cutoff Not active	• 1,000 rev • 200 rev	• 2 DCY • Immed.	– If a fuel system lean code is also set, perform diagnostics for that code first. – Check the spark plugs visually. – Check the intake system visually for leaks (false air) and check for an engine mechanical fault with a cylinder compression test. Refer to appropriate repair manual. – Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 . – Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .
P0321 Ignition/ Distributor Engine Speed Input Circuit Range/ Performance	Engine Speed Input Circuit Performance	• Comparison of counted teeth vs reference = incorrect • monitoring reference gap failure	---	• 1.5 s	• 2 DCY	– Check the Engine Speed Sensor -G28-. Refer to ⇒ E3.8.13 ngine Speed Sensor G28, Checking", page 239 .
P0322 Ignition/ Distributor Engine Speed Input Circuit No Signal	Engine Speed Input Circuit No Signal	• Camshaft signal > 3.0 • Engine speed, no signal	---	• 2.5 s	• 2 DCY	– Check the Engine Speed Sensor -G28-. Refer to ⇒ E3.8.13 ngine Speed Sensor G28, Checking", page 239 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0324 Knock/ Combustion Vibration Control System Error	Knock Control System Error	• Signal fault counter (combustion) > 24.0 or • Signal fault counter (measuring window) > 2.00	Engine speed > 2,500 RPM	• 0.5 s	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.8.26 nock Sensor 1G61, Checking", page 263 .
P0327 Knock/ Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor	Knock Sensor 1 Circuit Low Input	• Lower threshold < -70 V or for signal range check • > 0 – 1.60 V	• Engine speed, > 1,000 RPM or for signal range check • ECT > 41° C • Engine load > 45% - 60% • Engine speed > 2,000 RPM	• 0.5 - 3.0 s	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.8.26 nock Sensor 1G61, Checking", page 263 .
P0328 Knock/ Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor	Knock Sensor 1 Circuit High Input	• Upper threshold > 1.00 V or for signal range check • > 15.0 – 115.9 V	• Engine speed, > 1,000 RPM or for signal range check • ECT > 41° C • Engine load > 45% - 60% • Engine speed > 2,000 RPM	• 0.5 - 3.0 s	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.8.26 nock Sensor 1G61, Checking", page 263 .
P0340 Camshaft Position Sensor "A" Circuit Bank 1 or Single Sensor	Camshaft Position Sensor 1 Circuit	Cam adaption values out of range • > 20° KW • < -20° KW • Difference of adapted and actual values > 9° KW	• Engine speed sensor, No DTC • Phase sensor, No DTC • Cam adaptation, Active • Engine speed sensor, No DTC • Phase sensor, No DTC • Camshaft adjustment, No DTC • Engine start, Completed • Cam adaptation, Completed • Camshaft in ref pos. for > 2.0 s	• 2.0 s .	• 2 DCY	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.8.5 amshaft Position Sensor G40 , Checking ", page 223 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0341 Camshaft Position Sensor "A" Circuit Range/ Performance Bank 1 or Single Sensor	Camshaft Position Sensor 1 Circuit Performance	• Signal pattern incorrect	---	• 0.5 s	• 2 DCY	– Check the Camshaft Position Sensor -G40 -. Refer to ⇒ C3.8.5 amshaft Position Sensor G40 , Checking ", page 223 .
P0342 Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor	Camshaft Position Sensor Circuit 1 Low Input	• Signal voltage permanently low • Crankshaft signals = 8.0	---	• 0.5 s	• 2 DCY	– Check the Camshaft Position Sensor -G40 -. Refer to ⇒ C3.8.5 amshaft Position Sensor G40 , Checking ", page 223 .
P0343 Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor	Camshaft Position Sensor 1 Circuit High Input	• Signal voltage permanently high • Crankshaft signals = 8.0	---	• 0.5 s	• 2 DCY	– Check the Camshaft Position Sensor -G40 -. Refer to ⇒ C3.8.5 amshaft Position Sensor G40 , Checking ", page 223 .
P0351 Ignition Coil "A" Primary Control Circuit/ Open	Ignition Coil 1 Primary/ Secondary Circuit	• Signal current 0.25 – -2.0 mA • Internal check failed	• Engine speed > 680 RPM	• 0.5 s	• 2 DCY	– Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .
P0352 Ignition Coil "B" Primary Control Circuit/ Open	Ignition Coil 2 Primary/ Secondary Circuit	• Signal current 0.25 – -2.0 mA • Internal check failed	• Engine speed > 680 RPM	• 0.5 s	• 2 DCY	– Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .
P0353 Ignition Coil "C" Primary Control Circuit/ Open	Ignition Coil 3 Primary/ Secondary Circuit	• Signal current 0.25 – -2.0 mA • Internal check failed	• Engine speed > 680 RPM	• 0.5 s	• 2 DCY	– Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0354 Ignition Coil "D" Primary Control Circuit/ Open	Ignition Coil 4 Primary/ Secondary Circuit	• Signal current 0.25 – -2.0 mA • Internal check failed	• Engine speed > 680 RPM	• 0.5 s	• 2 DCY	– Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .
P0366 Camshaft Position Sensor "B" Circuit Range/ Performance Bank 1	Cam Position Sensor 2 Circuit Performance	• Signal pattern incorrect and defect counter = 12	---	• 0.5 s	• 2 DCY	– Check the Camshaft Position Sensor 3 -G300-. Refer to ⇒ C3.8.6 amshaft Position Sensor 3 G300, Checking", page 225 .
P0367 Camshaft Position Sensor "B" Circuit Low Bank 1	Cam Position Sensor 2 Circuit Low	• Signal voltage permanently low and crankshaft signals = 12.0	---	• 0.5 s	• 2 DCY	– Check the Camshaft Position Sensor 3 -G300-. Refer to ⇒ C3.8.6 amshaft Position Sensor 3 G300, Checking", page 225 .
P0368 Camshaft Position Sensor "B" Circuit High Bank 1	Cam Position Sensor 2 Circuit High	• Signal voltage permanently high and crankshaft signals = 12.0	---	• 0.5 s	• 2 DCY	– Check the Camshaft Position Sensor 3 -G300-. Refer to ⇒ C3.8.6 amshaft Position Sensor 3 G300, Checking", page 225 .
P0410 AIR System "A"	Secondary Air Injection System Fault	• Difference between ambient air pressure vs. secondary air pressure sensor > 0.50 kPa	• Air system commanded off • ECT between 5° – 108° C • IAT between 5° C – 75° C • Modeled catalyst temp < 700° C • Mass air flow 7 – 55 kg/h • Altitude < 2,700 m • Engine speed > 80 RPM	• 1.0 s	• Once • 2 DCY	– Check the Secondary Air Injection Pump Relay --J299- - / Secondary Air Injection Pump Motor -V101-. Refer to ⇒ S3.8.35 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking", page 283 . – Check the Secondary Air System -GX24-. Refer to ⇒ S3.8.36 econdary Air SystemGX24, Checking", page 285 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0413 AIR System Switching Valve "A" Circuit Open	Secondary Air Switching Valve Open	• Signal voltage 4.70 – 5.40 V	• Air valve commanded off • Engine speed > 80 RPM	• 0.5 s	• Continuous • 2 DCY	– Check the Secondary Air System -GX24-. Refer to ⇒ S3.8.36 econdary Air SystemGX24, Checking", page 285 .
P0414 AIR System Switching Valve "A" Circuit Shorted	Secondary Air Switching Valve Shorted	• Signal voltage 0.00 – 3.25 V or Signal current > 2.20 A	• Air valve commanded off for voltage check • Air valve commanded on for current check • Engine speed > 80 RPM	• 0.5 s	• Continuous • 2 DCY	– Check the Secondary Air System -GX24-. Refer to ⇒ S3.8.36 econdary Air SystemGX24, Checking", page 285 .
P0418 AIR System Control "A" Circuit	Secondary Air System Relay Circuit Open	• Signal voltage 4.70 – 5.40 V	• Pump relay commanded off • Engine speed > 80 RPM	• 0.5 s	• Once/DCY • 2 DCY	– Check the Secondary Air Injection (SAI) Pump Relay --J299- - / Secondary Air Injection Pump Motor -V101-. Refer to ⇒ S3.8.35 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking", page 283 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0420 Catalyst System Efficiency Below Threshold Bank 1	Catalyst System Efficiency Below Threshold	• Front: • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 0.40 • Front catalyst < 1.00 • Main catalyst < 1.20 • Main: • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 0.40 • Front catalyst < 0.90 • while value for front catalyst < 2.00	• Front: • Time after engine start > 10 – 40 s • Delta exhaust mass flow < 80.0 kg/h • Exhaust gas mass flow, lower range 25.0 – 80.0 kg/h • Exhaust gas mass flow upper range 35.0 – 110.0 kg/h • Modeled exhaust gas temp, 1,536.0 ° K • Modeled exhaust gas temp, upper range 450° C - 700° C • Engine speed 1,120 to 3,000 RPM • Number of checks, 2.0 • O2S front/rear, ready/no faults • SAS, not active • No misfire • Main: • Time after engine start > 80 s • Delta exhaust mass flow < 30.0 kg/h • Exhaust gas mass flow, lower range 25.0 - 80.0 kg/h • Exhaust gas mass flow upper range 60.0 - 160.0 kg/h • Modeled exhaust gas temp, lower range 435° C - 660° C • Modeled exhaust gas temp,	• 16.0 s	• Once/DCY • 2 DCY	– Check the Three Way Catalytic Converter (TWC). Refer to ⇒ W3.8.37 ay Catalytic Converter (TWC), Checking", page 288 . – Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			upper range 530° C - 740° C • Engine speed 1,200 – 3,520 RPM • Number of checks, 4 • O2S front/rear, ready/no faults • SAS, not active • No misfire			
P043E EVAP System Leak Detection Reference Orifice Low Flow	EVAP Leak Detection Reference Orifice Low Flow	• EVAP pump current during reference measurement > 40 mA	• Engine temp at engine start >= 4.0° C • Difference between ECT and IAT at engine start <= 6.80 Kelvin • Ambient air temp 4.0° – 35° C • Altitude <= 2,700 m • Time since engine start in preceding DCY >= 600 s. • Change in battery voltage during monitoring < 1.0 V • Engine off time > 5.0 s. • Vehicle speed 0.0 km/h	• 3.0 – 10 s	• Once / DCY • 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P043F EVAP System Leak Detection Reference Orifice High Flow	EVAP Leak Detection Reference Orifice High Flow	• EVAP pump current during reference measurement < 15.0 mA	• Engine temp at engine start >= 4.0° C • Difference between ECT and IAT at engine start <= 6.8 Kelvin • Ambient air temp 4.0° – 35° C • Altitude <= 2,700 m • Time since engine start in preceding DCY >= 600 s • Change in battery voltage during monitoring < 1.0 V • Engine off time > 5.0 s • Vehicle speed 0.0 km/h	• 3.0 – 10 s	• Once / DCY • 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking”, page 265 .
P0441 EVAP System Incorrect Purge Flow	Evaporative Emission System Incorrect Purge Flow	• Drop of EVAP pump current within time < 0.75 – 1.20 mA within 5 s	• Front O2S ready • Time since engine start >= 600 s • Engine speed > 20 RPM • EVAP purge commanded on • ECT > 41° C or startup ECT < 60° C • Ambient air temp 4.0° C – 35° C • Fuel volume flow <= 5.0 ml/ Sec. • Altitude < 2,700 m • Increase of EVAP pump current >= 0.3 mA within < 17 s	• 26.5 s	• Once / DCY • 2 DCY	– Verify an EVAP System leak is present. Refer to ⇒ S2.2.4 ystem, Checking For Leaks”, page 12 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.8.14 VAP Canister Purge Regulator Valve 1 N80, Checking”, page 240 . – Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking”, page 265 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0442 EVAP System Leak Detected (small leak)	Evaporative Emission System Leak Detected Small Leak	• Time for pressure drop < 1.60 - 1.85 s.	• Time after engine start 12.0 – 65,530 s. • ECT 3.8° C - 120° C • ECT at start 3.8° C – 50.3° C • Engine off time > 21,600 s • Ambient air temp 3.8° C – 59.3° C • Ambient air temp drop after start < 7.5 K • Intake manifold vacuum > -2,560 hPa • Altitude < 2,700 m • Vehicle speed >= 0.0 • Vehicle speed once > 40.0 km/h • Any drive gear • Restart temp diff. > 0.0 K • Purge valve closed • LDP active	• 400 s	• Once / DCY • 2 DCY	– Verify an EVAP System leak is present. Refer to ⇒ S2.2.4 ystem, Checking For Leaks", page 12 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.8.14 VAP Canister Purge Regulator Valve 1 N80, Checking", page 240 . – Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .
P0444 EVAP System Purge Control Valve "A" Circuit Open	Evaporative Emission System Purge Control Valve Circuit Open	• Signal voltage > 4.70 – 5.40 V	• EVAP purge valve Commanded Off • Engine speed > 80 RPM	• 0.5 s	• 2 DCY	– Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.8.14 VAP Canister Purge Regulator Valve 1 N80, Checking", page 240 .
P0447 EVAP System Vent Control Circuit Open	EVAP Vent Control Circuit Open	• Signal voltage 4.7 – 5.4 V	• EVAP pump solenoid valve commanded off	• 0.5 s	• Continuous • 2 DCY	– Check the EVAP Canister Purge Regulator Valve 2 -N115-. Refer to ⇒ E3.8.15 VAP Canister Purge Regulator Valve 2 N115, Checking", page 242 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0448 EVAP System Vent Control Circuit Shorted	EVAP Vent Control Circuit Shorted	• Signal voltage < 2.74 – 3.26 V • OR • Signal current > 2.2 – .0 A	• EVAP pump solenoid valve commanded off for voltage check or on for current check	• 0.5 s	• Continuous • 2 DCY	– Check the EVAP Canister Purge Regulator Valve 2 -N115-. Refer to ⇒ E3.8.15 VAP Canister Purge Regulator Valve 2 N115, Checking", page 242 .
P0449 EVAP System Vent Valve Control Circuit/ Open	EVAP System Vent Valve Circuit	• Signal voltage 2.8 – 3.2 V • OR • 4.5 – 5.3 V or signal current 220 – 980 µA	---	• 0.5 s	• Continuous • 2 DCY	– Check the EVAP Canister Purge Regulator Valve 2 -N115-. Refer to ⇒ E3.8.15 VAP Canister Purge Regulator Valve 2 N115, Checking", page 242 .
P0450 EVAP System Pressure Sensor/ Switch "A" Circuit	EVAP System Pressure Sensor Fault	• EVAP system vapor pressure after tank ventilation > 2 kPa	• Difference between ECT and AAT at start < 6.8 kelvin • ECT 3.8° C – 120° C • ECT at start 3.8° C – 50.3° C • Time after engine start < 120 s • Ambient air temp 4.0° C – 35 °C • Altitude < 2,700 m • Veh. speed 0 – 80 km/h • Fuel tank isolation valve ready	• 100.1 s	• Once • 2 DCY	– Check the Fuel Tank Pressure Sensor -G400-. Refer to ⇒ F3.8.22 uel Tank Pressure Sensor G400, Checking", page 255 .
P0451 EVAP System Pressure Sensor/ Switch "A" Circuit Range/ Performance	EVAP System Pressure Sensor Performance	• Difference between min. and max. vapor pressure < 0.05 kPa within 300 s.	• Vehicle speed 15 – 120 km/h • Time from engine start > 4.0 s • Altitude < 2,700 m • Ambient air temp 4.0° C - 35° C	• 300 s	• 2 DCY	– Check the Fuel Tank Pressure Sensor -G400-. Refer to ⇒ F3.8.22 uel Tank Pressure Sensor G400, Checking", page 255 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0452 EVAP System Pressure Sensor/ Switch "A" Circuit Low	EVAP Emission System Pressure Sensor Low	• Signal voltage < 0.20 V	---	• 0.5 s	• Continuous • 2 DCY	– Check the Fuel Tank Pressure Sensor -G400-. Refer to ⇒ F3.8.22 uel Tank Pressure Sensor G400, Checking", page 255 .
P0453 EVAP System Pressure Sensor/ Switch "A" Circuit High	EVAP Emission System Pressure Sensor High	• Signal voltage > 4.80 V	---	• 0.5 s	• Continuous • 2 DCY	– Check the Fuel Tank Pressure Sensor -G400-. Refer to ⇒ F3.8.22 uel Tank Pressure Sensor G400, Checking", page 255 .
P0455 EVAP System Leak Detected (large leak)	Evaporative Emission System Leak Detected	• Time for pressure drop < 1 s	• Time after engine start 12 – 65,530 s. • ECT 3.8° C – 120° C • ECT at start 3.8° C – 50.3° C • Engine off time > 21,600 Sec. • Ambient air temp 3.8° C – 59.3° C • Ambient air temp drop after start < 12.5 K • Intake manifold vac. > -2,560 hPa • Altitude < 2,700 m • Vehicle speed >= 0.0 km/h • Vehicle speed once > 40 km/h • Any drive gear • Restart temp diff. > 0.0 K • Purge valve closed • LDP active	• 120 s	• 2 DCY	– Verify an EVAP System leak is present. Refer to ⇒ S2.2.4 ystem, Checking For Leaks", page 12 . – If a leak is present, repair the leak and retest with the smoke machine. If no leak is found and the pressure does not drop during testing with the smoke machine: – Check the EVAP Leak Detection Pump (LDP) - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0456 EVAP System Leak Detected (Very Small Leak)	Evaporative Emission System Leak Detected very small leak	• Time for pressure drop, < 4.5 - 6.0 s	• s • Engine off time > 21600 Sec. • Ambient air temp 3.8° C – 59.3° C • Ambient air temp drop after start < 4.5 K • Intake manifold vac. > -2,560 hPa • Intake manifold vac. > -2,560 hPa • Altitude < 2,700 m • Veh. speed >= 0.0 km/h • Veh speed once > 40 km/h • Any drive gear • Restart temp diff. > 0.0 K • Purge valve closed • LDP active	• 56 s • once/ DCY 1	• 2 DCY	– Verify an EVAP System leak is present. Refer to ⇒ S2.2.4 ystem, Checking For Leaks", page 12 . – If a leak is present, repair the leak and re-test with the smoke machine. If no leak is found and the pressure does not drop during testing with the smoke machine: – Check the EVAP Leak Detection Pump -V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .
P0458 EVAP System Purge Control Valve "A" Circuit Low	Evaporative Emission System Purge Control Valve Circuit Low	• Signal voltage 0.0 – 3.25 V	• EVAP purge valve, Commanded off • Engine speed > 80 RPM	• 0.5 s	• 2 DCY	– Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.8.14 VAP Canister Purge Regulator Valve 1 N80, Checking", page 240 .
P0459 EVAP System Purge Control Valve "A" Circuit High	Evaporative Emission System Purge Control Valve Circuit High	• Signal current > 2.2 A	• EVAP purge valve, Commanded On • Engine speed > 80 RPM	• 0.5 s	• 2 DCY	– Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.8.14 VAP Canister Purge Regulator Valve 1 N80, Checking", page 240 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0491 AIR System Insufficient Flow Bank 1	Secondary Air System Low Flow	• Average pressure difference between absolute value and filtered value < 0.15 to 0.90 kPa and relative AIR pressure measured > 0.50 kPa	• ECT between 5° C – 108° C • IAT between 5° C – 75° C • Modeled catalyst temp < 700° C • Mass air flow 7.0 to 55 kg/h • Altitude < 2,700 m • Engine speed > 80 RPM • Air system commanded off	• 0.0 s	• Once • 2 DCY	– Check the Secondary Air hoses for disconnected, kinked or tears in the tubing. If OK: – Check the Secondary Air System -GX24-. Refer to ⇒ S3.8.36 econdary Air SystemGX24, Checking", page 285 .
P0496 EVAP System High Purge Flow	EVAP System High Purge Flow	• Actual pump current difference between reference measurement to idle divided by pump current difference from the last leak detection phase during engine off > 1.40	• ECT > 41° C • ECT at start < 60° C • Ambient air temp > 4.0° – < 35° C • Altitude <= 2,700 m • Time since engine start >= 600 s • Intake manifold vacuum > 4.0 kPa • Vehicle speed 20 – 120 km/h • Engine speed > 20 RPM • Front O2S ready • EVAP purge commanded off	• 4.5 s	• 2 DCY	– Check for a stuck open valve. The valve should be normally closed when voltage/ground is not applied. Check for software updates before performing diagnostics. If the ECM software is current: – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.8.14 VAP Canister Purge Regulator Valve 1 N80, Checking", page 240 .
P04B5 Fuel Fill Door Stuck Open	Fuel Fill Door Stuck Open	• Accumulative fuel consumption since refuel > 144.0		• 0.0 s	• Continuous • 1 DCY	– Check the Fuel Filler Detection Switch -F334-. Refer to ⇒ F3.8.18 uel Filler Detection SwitchF334, Checking", page 248 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P04DB Crankcase Ventilation System Disconnected	Crankcase Ventilation System Disconnected	• Signal voltage > 2.5 V		• 1.0 s	• Continuous • 2 DCY	– Check the positive crankcase ventilation heater. Refer to ⇒ P3.8.34 ositive Crankcase Ventilation Heating ElementN79, Checking", page 281 .
P04ED EVAP System Large Leak Detected - Fresh Air Side	EVAP System Large Leak Detected Fresh Air Side	• Modeled pressure from pump current < 0.90 kPa	• Engine temp at engine start >= 4.0° C • Difference between ECT and IAT at engine start <= 6.8 Kelvin • Ambient air temp 4.0° – 35° C • Altitude <= 2,700 m • Time since engine start in preceding DCY >= 600 s. • Change in battery voltage during monitoring < 1 V • Engine off time > 5.0 s. • Vehicle speed 0.0 km/h	• 60 s	• Once / DCY • 2 DCY	– Check for software updates before performing diagnostics on the Leak Detection Pump. If the ECM software is current: – Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P04EF EVAP System Very Small Leak Detected - Fresh Air Side	EVAP System Very Small Leak Detected Fresh Air Side	• EVAP leakage area calculated from pump current curve > 0.12 mm2	• Engine temp at engine start >= 4.0° C • Difference between ECT and IAT at engine start <= 6.8 Kelvin • Ambient air temp 4.0°– 35 °C • Altitude <= 2700 m • Time since engine start in preceding DCY >= 600 s • Change in battery voltage during monitoring < 1 V • Engine off time > 5.0 s • Vehicle speed 0.0 km/h	• 120 s	• Once / DCY • 2 DCY	– Check for software updates before performing diagnostics on the Leak Detection Pump. If the ECM software is current: – Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .
P04F0 EVAP System High Load Purge Line "A" Performance	EVAP System High Pressure Purge Line Performance	• Drop of EVAP pump current < .070 to 1.10 mA within 2.5 s .	• Front O2S ready • Time since engine start >= 600 s • Engine speed > 20 RPM • EVAP purge commanded on • ECT > 41° C or startup ECT < 60° C • Ambient air temp 4.0° C to 35° C • Fuel volume flow <= 5.0 ml/s. • Altitude < 2,700 m • Increase of EVAP pump current >= 0.3 mA within < 17.0 s.	• 26.5 s	• Once / DCY • 2 DCY	– Check for software updates before performing diagnostics on the Leak Detection Pump. If the ECM software is current: – Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0501 Vehicle Speed Sensor "A" Circuit Range/ Performance	Vehicle Speed Sensor Range/ Performance	• VSS signal < 6 km/h	• Engine torque > 120.0 Nm • Engine speed > 2,800 RPM	• 2,000 ms	• 2 DCY	– Check vehicle speed signal. Refer to ⇒ S3.8.39 peed Sensor, Checking", page 292 .
P0502 Vehicle Speed Sensor "A" Circuit Low	Vehicle Speed Sensor Circuit Low	• Failure		• 0.5 s	• 2 DCY	– Check vehicle speed signal. Refer to ⇒ S3.8.39 peed Sensor, Checking", page 292 .
P0503 Vehicle Speed Sensor "A" Circuit Intermittent/ Erratic/ High	Vehicle Speed Sensor Intermittent/ Erratic/ High	• Vehicle speed > 290 km/h		• 0.5 s	• 2 DCY	– Check vehicle speed signal. Refer to ⇒ S3.8.39 peed Sensor, Checking", page 292 .
P0506 Idle Control System RPM - Lower Than Expected	Idle Air Control System RPM Lower Than Expected	• Idle speed Deviation > 80 RPM and RPM controller torque value <= calculated min. value OR • Integrated deviation of engine speed low and engine speed high > 2,000 RPM	• Vehicle speed 0.0 MPH • Altitude < 2,700 m • IAT, > -48° C • ECT, > -48° C • Time after engine start > 0.0 s • External torque request not demanded • Engine speed = idle	• 3 - 5 s	• 2 DCY	– If the engine idle is rough, check for a vacuum leak. See code P2279 for detail. – Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking", page 289 .
P0507 Idle Control System RPM - Higher Than Expected	Idle Air Control System RPM Higher Than Expected	• Idle speed Deviation < -80 RPM and RPM controller torque value >= calculated max. value • Integrated deviation of engine speed low and engine speed high > 2,000 RPM	• Vehicle speed 0.0 MPH • Altitude < 2,700 m • IAT, > -48° C • ECT, > -48° C • Time after engine start > 0.0 Sec. • External torque request not demanded • Engine speed = idle	• 7.0 s	• 2 DCY	– Check the throttle plate for sticking or mechanical binding. If any binding occurs, replace the assembly. – Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking", page 289 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P050A Cold Start Idle Control System Performance	Cold Start Idle Air Control System Performance	• Out of range low: • Engine speed deviation < -80 RPM Out of range high: • Engine speed deviation > 80 RPM	• Time after engine start > 0.0 s • Driver torque demand - none • Veh speed 0.0 km/h • Altitude < 2,700 m • IAT > -48.0° C • Catalyst heating active	• 3 - 4 s	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking", page 289 . – Check accuracy of the ECT (G62) sensor. Make sure that at cold ambient, (the temperature displayed on the scan tool) matches actual coolant temperature within 5%.
P050B Cold Start Ignition Timing Performance	Timing Adjustment Malfunction During Cold Start at Idle	• Difference between commanded spark timing vs. actual value 20 – 50%	• Time during catalyst heating > 10.0 s • Commanded spark retard during catalyst heating < 70% • Idle speed active • Vehicle speed 0.0 km/h	• 8.0 s	• 2 DCY	– Check for any engine speed sensor or ignition coil faults and diagnose them first. If no other codes are set, replace the Engine Control Module -J623-. Refer to appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P052A Cold Start "A" Camshaft Position Timing Over-Advanced Bank 1	Cold Start Intake Camshaft Position Timing Over-Advanced	• Difference between target vs. actual position > 12° – 40° CRK	• Time after engine start >= 1 s. • Engine speed >= 600 RPM • Modelled oil temperature >= -35° C • Catalyst heating active	• 3.0 s	• 2 DCY	– Check engine oil for incorrect viscosity or in need of servicing (dirty oil). Oil that is not clear in color may be causing the sensor to operate incorrectly. The engine oil must be clean and of the correct viscosity in order for the sensor to operate properly. Check the vehicle paperwork to determine what oil viscosity has been used and when the last oil change was performed. Change the engine oil if necessary. – Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.8.4 amshaft Adjustment Valve 1 N205, Checking ", page 221 .
P053F Cold Start Fuel Pressure Performance Bank 1	Cold Start Fuel Pressure Performance	• Difference between target vs. actual pressure < -1.50 • OR • > 1.50 MPa	• Time after engine start 3 s • Fuel cutoff not active	• 3.5 s	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ C3.1 heck ", page 19 and/or to appropriate repair manual. – If the fuel pressure is out of range: check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P054A Cold Start "B" Camshaft Position Timing Over-Advanced Bank 1	Cold Start Exhaust Camshaft Position Timing Over-Advanced	• Difference between target vs. actual position > 12° – 40° CRK	• Time after engine start >= 1 s • Engine speed >= 600 RPM • Modelled oil temperature >= -35° C • Catalyst heating active	• 3.0 s	• 2 DCY	– Check the Exhaust Camshaft Adjustment Valve 1 -N318-. Refer to ⇒ E3.8.16 xhaust Camshaft Adjustment Valve 1 N318, Checking ", page 244 .
P0555 Brake Booster Pressure Sensor Circuit	Brake Booster Pressure Sensor Circuit	• Sensor voltage > 4.90 V	• Time after ignition on > 500 ms	• 0.4 s	• Continuous • 2 DCY	– Check the Brake Booster Pressure Sensor -G294-. Refer to ⇒ B3.8.2 rake Booster Pressure Sensor G294, Checking", page 216 . – AND ⇒ B3.8.3 rake Booster ReJ569 / Brake Booster Vacuum Pump V192, Checking", page 218 .
P0556 Brake Booster Pressure Sensor Circuit Range/ Performance	Brake Booster Pressure Sensor Circuit Performance	• Difference between brake booster pressure vs. ambient pressure > 10 kPa or gradient brake booster pressure > 1.5 kPa	• Brake light switch off	• 0.6 s	• Multiple • 2 DCY	– Check the Brake Booster Pressure Sensor -G294-. Refer to ⇒ B3.8.2 rake Booster Pressure Sensor G294, Checking", page 216 . – AND ⇒ B3.8.3 rake Booster ReJ569 / Brake Booster Vacuum Pump V192, Checking", page 218 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0557 Brake Booster Pressure Sensor Circuit Low	Brake Booster Pressure Sensor Circuit Low	• Sensor voltage < 0.19 V	• Time after ignition on > 500 ms	• 0.4 s	• Continuous • 2 DCY	– Check the Brake Booster Pressure Sensor -G294-. Refer to ⇒ B3.8.2 rake Booster Pressure Sensor G294, Checking", page 216 . – AND ⇒ B3.8.3 rake Booster ReJ569 / Brake Booster Vacuum Pump V192, Checking", page 218 .
P056E Cold Start Turbocharger/Supercharger Boost Control "A" Performance	Cold Start Turbocharger Boost Control Performance	• Difference between target and actual position < -12% • OR • > 12%	• Engine running • Catalyst heating active • Position sensor from max range < 70% • OR • > 70%	• 1.0 s	• Continuous • 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.8.10 harge Air Pressure ActuatorV465 / Charge Air Pressure Actuator Position SensorG581, Checking", page 233 .
P0571 Brake Switch "A" Circuit	Cruise/Brake Switch (A) Circuit Malfunction	• CAN Message		• 2.0 s	• Continuous • 2 DCY	– Check the brake light switch and its associated circuits. Refer to appropriate electrical schematic.
P057B Brake Pedal Position Sensor "A" Circuit Range/Performance	Brake Pedal Position Sensor	• Duty cycle > 92% – < 8% • Time > 5.0 ms – < 4.0 ms • No position sensor signal • Offset adaption value > 92% – < 60%	• Brake light switch pressure of brake system - not active - < 200 kPa	• 2.0 s	• Continuous • 2 DCY	– Check the brake light switch and its associated circuits. Refer to appropriate electrical schematic.
P0606 ECM/PCM Processor	ECM Processor Fault	• ECM internal check failure	• Key on or engine running	• 2.0 s	• Continuous • 2 DCY	– Replace the Engine Control Module -J623-. Refer to the Repair Manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P062B Internal Control Module Fuel Injector Control Performance	Internal ECM Driver for Fuel Injector Control, Performance	• Internal logic failure	• Engine Control Module -J623- gine speed > 80 RPM	• 0.5 s	• 2 DCY	– Perform an injector test to check for shorted circuit or shorted injector before replacing ECM. – . Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 . – When circuit/ injector faults have been corrected or no faults have been found with injector or wiring: – Replace the Engine Control Module -J623-. Refer to the Repair Manual.
P0634 Control Module Internal Temperature "A" Too High	ECM Internal Temperature Too High	• Power stage temperature > 170° C	• Ignition on	• 0.5 s	• Continuous • 2 DCY	– Check for any engine sensor/ component fault codes set and repair those codes first. If no other codes are set, replace the ECM. Refer to the Repair Manual for procedure.
P0638 Throttle Actuator Control Range/ Performance Bank 1	Throttle Actuator Control Range/ Performance	• Time to close to reference point > 0.6 s and • reference point 2.88% • TPS 1 signal voltage NOT 0.40 to 0.80 V • TPS 2 signal voltage NOT 4.20 to 4.60 V • TPS 1 + TPS 2 NOT 4.82 to 5.18 V	• Ignition on • Engine speed 0.0 RPM • Vehicle speed 0.0 km/h • ECT > 5.30° – 143.3° C • IAT > 5.30° – 143.3° C	• 0.3 - 5.0 s	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking", page 289 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0641 Sensor Reference Voltage "A" Circuit/Open	Sensor Reference Voltage A Circuit Open	• Signal voltage deviation > +/- 0.3 V	---	• 0.5 s	• 2 DCY	– Check for any sensor voltage faults, and diagnose any sensor voltage codes first. If no other codes are set: – Replace the Engine Control Module -J623-. Refer to the Repair Manual.
P0651 Sensor Reference Voltage "B" Circuit/Open	Sensor Reference Voltage B Circuit Open	• Signal voltage deviation > +/- 0.3 V	---	• 0.5 s	• 2 DCY	– Check for any sensor voltage faults, and diagnose any sensor voltage codes first. If no other codes are set: – Replace the Engine Control Module -J623-. Refer to the Repair Manual.
P0657 Actuator Supply Voltage "A" Circuit/Open	Actuator Supply Voltage Circuit Open	• Signal voltage, > 4.4 – 5.6 V	• Relay, commanded off • Engine speed > 80 RPM	• 0.5 s	• 2 DCY	– Check for any sensor voltage faults, and diagnose any sensor voltage codes first. If no other codes are set: – Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.8.29 otronic Engine Control Module Power Supply RelayJ271, Checking", page 269 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0658 Actuator Supply Voltage "A" Circuit Low	Actuator Supply Voltage Circuit Low	• Signal voltage, < 2.15 – 3.25 V	• Relay, commanded off • Engine speed > 80 RPM	• 0.5 s	• 2 DCY	– Check for any actuator voltage faults, and diagnose any actuator voltage codes first. If no other codes are set: – Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.8.29 otronic Engine Control Module Power Supply ReJ271, Checking", page 269 .
P0659 Actuator Supply Voltage "A" Circuit High	Actuator Supply Voltage Circuit High	• Signal current > 1.1 A	• Relay, commanded on • Engine speed > 80 RPM • Battery voltage test counter, 9.04 – 16 V > 3	• 0.5 s	• 2 DCY	– Check for any actuator voltage faults, and diagnose any actuator voltage codes first. If no other codes are set: – Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.8.29 otronic Engine Control Module Power Supply ReJ271, Checking", page 269 .
P0697 Sensor Reference Voltage "C" Circuit/Open	Sensor Reference Voltage C Circuit Open	• Signal voltage deviation > +/- 0.3 V	---	• 0.5 s	• 2 DCY	– Check for any sensor voltage faults, and diagnose any sensor voltage codes first. If no other codes are set: – Replace the Engine Control Module -J623-. Refer to the Repair Manual.
P0703 Brake Switch "B" Circuit	Torque Converter/ Brake Switch B Circuit Malfunction	• Signal voltage >2,430 mV – <10 mV	---	• 2.0 s	• 2 DCY	– Check the brake light switch and its associated circuits. Refer to appropriate electrical schematic.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0A93 Inverter "A" Cooling System Performance	Inverter "A" Cooling System Performance	• Gradient of inverter temperature >14.0 – 30.0 K/min	---	• 2.0 s	• 2 DCY	– Consult Appropriate Repair Manual for diagnosis and repair.
P12A1 Fuel Rail Pressure Sensor Inappropriately Low	Fuel Rail Pressure Sensor Inappropriately Low	• Pressure control activity > 0.20 MPa • Fuel trim activity < 0.80 • Difference between actual pressure vs target pressure -16.38 – 16.38 MPa	• Engine speed > 600 RPM • EVAP purge adaption < 22.0 • Lambda control closed loop • Fuel cutoff not active	• 5 s	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ C3.1 heck ", page 19 and/or to appropriate repair manual. – If the actual fuel pressure does not match the (low) scan tool reading: – Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.8.21 uel Pressure SensorG247, Checking", page 254 . – If the actual fuel pressure matches the (low) scan tool reading: – Check the Fuel Pressure Regulator Valve - N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P12A2 Fuel Rail Pressure Sensor Inappropriately High	Fuel Rail Pressure Sensor Inappropriately High	• Pressure control activity < -0.06 MPa • Fuel trim activity > 1.65 • Difference between target pressure and actual pressure -16.38 to 16.38 MPa	• Engine speed > 600 RPM • EVAP purge adaption < 22.0 • Lambda control closed loop • Fuel cutoff not active	• 5.0 s	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ C3.1 heck ", page 19 and/or to appropriate repair manual. : – If the actual fuel pressure does not match the (high) scan tool reading check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.8.21 uel Pressure SensorG247, Checking", page 254 . – If the actual fuel pressure matches the (high) scan tool reading: check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 .
P12A4 Fuel Rail Pump Control Valve Stuck Closed	Fuel Rail Pump Control Valve Stuck Closed	• Fuel trim activity 0.90 – 1.15 • Pressure control activity < -6 MPa • System Deviation < 16.38 MPa	• Engine speed > 600 RPM • EVAP purge adaption < 22.0 • Lambda control closed loop • Fuel cutoff not active	• 5.0 s	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 .
P1388 Control Module Faulty	ECM Internal Fault	• Operation mode incorrect	---	• 5.0 s	• 2 DCY	– Replace the Engine Control Module -J623-. Refer to the Repair Manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P13EA Cold Start Ignition Timing Performance Off Idle	Timing Adjustment Malfunction During Cold Start	• Difference between commanded spark timing vs. actual value > 40%	• Time during catalyst heating > 12 s • Commanded spark retard during catalyst heating < 100% • Idle speed not active • Vehicle speed >= 5.0 km/h	• 10.0	• 2 DCY	– This code will set due to poor fuel quality or fuel that has aged. Poor fuel quality will cause a delay in the cylinder firing pulse monitored by the engine speed sensor. Drain the fuel from the vehicle and replace with fresh gasoline.
P1427 Brake Vacuum Pump Activation Short Circuit To B+	Brake Vacuum Pump Activation Circuit Short To Voltage	• Signal current > 2.2 A	• Engine speed > 80 RPM • Electrical vacuum pump commanded on	• 0.5 s .	• Continuous • 2 DCY	– Check the Brake Booster Relay - J569- / Brake System Vacuum Pump -V192-. Refer to ⇒ B3.8.3 rake Booster RelayJ569 / Brake Booster Vacuum Pump V192, Checking", page 218 .
P1428 Brake Vacuum Pump Activation Short Circuit To Ground	Brake Vacuum Pump Activation Circuit Short To Ground	• Signal voltage < 2.15 V	• Engine speed > 80 RPM	• 0.5 s	• Continuous • 2 DCY	– Check the Brake Booster Relay - J569- / Brake System Vacuum Pump -V192-. Refer to ⇒ B3.8.3 rake Booster RelayJ569 / Brake Booster Vacuum Pump V192, Checking", page 218 .
P1429 Brake Vacuum Pump Activation Open Circuit	Brake Vacuum Pump Activation Circuit Open	• Signal voltage > 4.4 – 5.6 V	• Engine speed > 80 RPM	• 0.5 s	• Continuous • 2 DCY	– Check the Brake Booster Relay - J569- / Brake System Vacuum Pump -V192-. Refer to ⇒ B3.8.3 rake Booster RelayJ569 / Brake Booster Vacuum Pump V192, Checking", page 218 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P150A Engine Off Timer Performance	Engine Off Timer Performance	• Difference between engine off time and ECM after run time < -12 s • OR • > 12 s .	• Key on after ECM after run time active • Key on during ECM after run time active • CAN active	• 6.0 s	• 2 DCY	– Check for related TSB's. If none apply; check the power and ground inputs to the ECM BEFORE replacing ECM. Lack of ignition off power supply will cause the timer to stop. Refer to the Wiring Diagrams for power and ground locations to the ECM. If power and grounds are present at the ECM; replace the Engine Control Module -J623-. Refer to the Repair Manual.
P169A Loading Mode Active	Transport Mode Active	• Transport mode active	• Production mode not active and vehicle mileage below 100 km	• 0.0 s	• 1 DCY	– Vehicle is in Transport Mode (Loading Mode). It can be turned off with a scan tool or will automatically switch off after approximately 100 km (62.15 miles) have accumulated on the vehicle. May need to perform readiness check. Refer to ⇒ C3.2 ode ", page 21 .
P2088 "A" Camshaft Position Actuator Control Circuit Low Bank 1	A Camshaft Position Actuator Control Circuit Low	• Signal voltage 0.0 – 3.25 V	• Camshaft valve off • Engine speed > 80 RPM	• 0.5 s	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.8.4 amshaft Adjustment Valve 1 N205, Checking ", page 221
P2089 "A" Camshaft Position Actuator Control Circuit High Bank 1	A Camshaft Position Actuator Control Circuit High Bank 1	• Signal current > 2.2 A	• Camshaft valve on • Engine speed > 80 RPM	• 0.5 s	• Continuous • 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.8.4 amshaft Adjustment Valve 1 N205, Checking ", page 221 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2090 "B" Camshaft Position Actuator Control Circuit Low Bank 1	Exhaust Camshaft Position Actuator Control Circuit Low	• Signal voltage 0.0 – 3.25 V	• Camshaft valve commanded off • Engine speed > 80 RPM	• 0.5 s	• 2 DCY	– Check the Camshaft Adjustment Valve -N318-. Refer to ⇒ E3.8.16 xhaust Camshaft Adjustment Valve 1 N318, Checking ", page 244 .
P2091 "B" Camshaft Position Actuator Control Circuit High Bank 1	Exhaust Camshaft Position Actuator Control Circuit High	• Signal current 2.20 A	• Camshaft valve commanded off • Engine speed > 80 RPM	• 0.5 s	• 2 DCY	– Check the Camshaft Adjustment Valve -N318-. Refer to ⇒ E3.8.16 xhaust Camshaft Adjustment Valve 1 N318, Checking ", page 244 .
P2096 Post Catalyst Fuel Trim System Too Lean Bank 1	Post Catalyst Fuel Trim System Too Lean	• Deviation lambda control < -0.04	• Modeled exhaust gas temp 450° – 850° C • Exhaust gas mass flow 14.0 – 300 kg/h • Lambda control in closed loop, not at min or max limit • O2S front ready, no DTC • O2S rear ready, no DTC • O2 heaters active • Not in fuel cut-off, SAI off • Catalyst heating not active	• 0.0 s	• Continuous • 2 DCY	– Check the fuel pressure and delivery quantity. – Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 . – Check the Three Way Catalytic Converter (TWC). Refer to ⇒ W3.8.37 ay Catalytic Converter (TWC), Checking", page 288 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2097 Post Catalyst Fuel Trim System Too Rich Bank 1	Post Catalyst Fuel Trim System Too Rich	• Integral part of lambda control > 0.04%	• Modeled exhaust gas temp 450° – 850° C • Exhaust gas mass flow 14.0 – 300 kg/h • Lambda control in closed loop, not at min or max limit • O2S front ready, no DTC • O2S rear ready, no DTC • O2 heaters active • Not in fuel cut-off, SAI off • Catalyst heating not active	• 0.0 s	• Continuous • 2 DCY	– Check the fuel pressure and delivery quantity. – Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking”, page 273 . – Check the Three Way Catalytic Converter (TWC). Refer to ⇒ W3.8.37 ay Catalytic Converter (TWC), Checking”, page 288 .
P2101 Throttle Actuator "A" Control Motor Circuit Range/ Performance	Throttle Actuator Control Motor Circuit Range/ Performance	• Duty cycle > 80% • Deviation throttle value angles vs. calculated value 4% - 50% • ECM power stage no failure	• Duty cycle > 80% or deviation throttle value angles vs. calculated value > 4.0% - 50%	• 0.5 – 5.0 s	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking”, page 289 .
P2106 Throttle Actuator Control System - Forced Limited Power	Throttle Actuator Control System - Forced Limited Power	• Internal check failed	• Duty cycle > 80% or deviation throttle value angles vs. calculated value > 4.0% - 50%	• 0.5 s	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking”, page 289 .
P2122 Throttle/ Pedal Position Sensor/ Switch "D" Circuit Low	Accelerator Pedal Position Sensor D Circuit Low Input	• Signal voltage < 0.61 V	---	• 0.5 s	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.8.1 ccelerator Pedal Module GX2, Checking”, page 214 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2123 Throttle/ Pedal Position Sensor/ Switch "D" Circuit High	Accelerator Pedal Position Sensor D Circuit High Input	• Signal voltage > 4.79 V	---	• 0.5 s	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.8.1 ccelerator Pedal Module GX2, Checking", page 214 .
P2127 Throttle/ Pedal Position Sensor/ Switch "E" Circuit Low	Accelerator Pedal Position Sensor E Circuit Low Input	• Signal voltage < 0.27 V	---	• 0.5 s	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.8.1 ccelerator Pedal Module GX2, Checking", page 214 .
P2128 Throttle/ Pedal Position Sensor/ Switch "E" Circuit High	Accelerator Pedal Position Sensor E Circuit High Input	• Signal voltage > 2.43 V	---	• 0.5 s	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.8.1 ccelerator Pedal Module GX2, Checking", page 214 .
P2138 Throttle/ Pedal Position Sensor/ Switch "D"/"E" Voltage Correlation	Accelerator Pedal Position Sensor D/E Voltage Correlation	• Signal voltage: Difference between signal APP1 and APP2 > 0.17 - 0.70 V	• Signal voltage sensor 1 > 445.0 mv • Signal voltage sensor 2 > 445.0 mv	• 0.5 s	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.8.1 ccelerator Pedal Module GX2, Checking", page 214
P2146 Fuel Injector Group "A" Supply Voltage Circuit/Open	Fuel Injector Group A Supply Voltage Circuit Open	• Signal current > 14.90 A or • Signal current, < 2.6 A	• Engine speed > 80 RPM or • Low side signal current >2.70 A	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .
P2149 Fuel Injector Group "B" Supply Voltage Circuit/Open	Fuel Injector Group B Supply Voltage Circuit Open	• Signal current > 14.90 A or • Signal current, < 2.6 A	• Engine speed > 80 RPM or • Low side signal current > 2.70 A	• 0.5 s	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2177 System Too Lean Off Idle Bank 1	System Too Lean Off Idle	• Adaptive value > 28%	• Engine speed 1,280 – 6,000 RPM • Engine load 17 – 45% • MAF 5.0 – 26 kg/h • ECT > 63° C • IAT < 90° C • O2 ready, closed loop • EVAP purge valve closed	• 10.0 s	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ C3.1 heck ", page 19 and/or to appropriate repair manual. – If the fuel pressure is out of range: check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 . – If the Fuel Pressure is OK: check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2178 System Too Rich Off Idle Bank 1	System too rich off idle, Bank 1	• Adaptive value < -21%	• Engine speed 1,280 – 6,000 RPM • Engine load 17 – 45% • MAF 5.0 to 26 kg/h • ECT > 63° C • IAT < 90° C • O2 ready, closed loop • EVAP purge valve closed	• 10.0 s	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ C3.1 heck ", page 19 and/or to appropriate repair manual. – If the fuel pressure is out of range: check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 . – If the Fuel Pressure is OK: check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.8.14 VAP Canister Purge Regulator Valve 1 N80, Checking", page 240 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2181 Cooling System Performance	Cooling System Performance	• Cooling system temperature too low after a sufficient mass air flow integral 74° – 84° C	• Begin of air mass integration when engine temp > 30° C • ECT at start, -6.7° – 64.5° C • Ambient air temp -6.7° C • Fuel cutoff not active and engine load 0 - 400% • Delta ambient pressure < 1.5 kPa • Integrated air mass depending on engine temp at start and ambient air temperature 3.2 – 23.8 kg/h • Accumulated fuel cutoff < 40 – 250 s At time of fault decision • Average mass air flow 20 – 154 kg/h • Average vehicle speed 33.4 – 120 km/h	• 2.0 s	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.8.11 ngine Coolant Temperature Sen-sorG62, Checking”, page 235 . – Check the High Temperature Circuit Coolant Pump -V467-. Refer to ⇒ H3.8.23 igh Temperature Coolant Pump V467, Checking”, page 257 . – Check the Low Temperature Circuit Coolant Pump -V468-. Refer to ⇒ L3.8.28 ow Temperature Circuit Coolant Pump V468, Checking ”, page 267 . – Check the engine coolant thermostat. Refer to appropriate repair manual.
P2184 Engine Coolant Temperature Sensor 2 Circuit Low	Engine Coolant Temperature Sensor 2 Circuit Low	• ECT outlet > 141 °C	---	• 2.0 s	• 2 DCY	– Check the Engine Coolant Temperature Sensor on Radiator Outlet -G83-. Refer to ⇒ E3.8.12 ngine Coolant Temperature Sensor On Radiator OutletG83, Checking”, page 237 .
P2185 Engine Coolant Temperature Sensor 2 Circuit High	Engine Coolant Temperature Sensor 2 Circuit High	• ECT outlet < -43 °C	---	• 2.0 s	• 2 DCY	– Check the Engine Coolant Temperature Sensor on Radiator Outlet -G83-. Refer to ⇒ E3.8.12 ngine Coolant Temperature Sensor On Radiator OutletG83, Checking”, page 237 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2187 System Too Lean at Idle Bank 1	System Too Lean at Idle	• Adaptive value > 5.02%	• Engine speed 520 – 1,200 RPM • Engine load < 17% – 45% • MAF < 5.0 – 26 kg/h • ECT > 63° C • IAT < 90° C • Delta part load adaptation ready • O2 ready, in closed loop	• 10.0 s	• 2 DCY	– Check for air leaking into the engine through the oil fill cap (not seated) or oil dipstick not seated in tube. Also any engine gaskets (oil cap, valve cover, etc.) that can cause additional air to enter the crankcase can set this fault. If a vacuum leak or crankcase sealing is at cause, the idle may be rough or unstable. – Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ C3.1 heck ", page 19 and/or to appropriate repair manual. – Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.8.21 uel Pressure SensorG247, Checking", page 254 . – Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2188 System Too Rich at Idle Bank 1	System Too Rich at Idle	• Adaptive value < -6.19%	• Engine speed 520 –1,200 RPM • Engine load < 17% – 45% • MAF < 5.0 – 26 kg/h • ECT > 63° C • IAT < 90° C • Delta part load adaptation ready • O2 ready, in closed loop	• 35.0 s	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ C3.1 heck ", page 19 and/or to appropriate repair manual. – If the fuel pressure is out of range: check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 . – If the Fuel Pressure is OK: check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.8.14 VAP Canister Purge Regulator Valve 1 N80, Checking", page 240 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2195 2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 1	O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 1	• Delta lambda of 2nd lambda control loop > 0.06	• Modeled exhaust gas temp 450° – 850° C • Delta engine load < 20% • Exhaust gas mass flow 14 – 300 kg/h • Lambda control, 2nd lambda control, closed loop • O2S front, rear and heaters ready - no fault • Fuel cutoff, catalyst heating, SAI - not active	• 120.0 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276
P2196 O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 1	O2 Sensor Signal Biased/ Stuck Rich - Bank 1 Sensor 1	• Delta lambda of 2nd lambda control loop < -0.07	• Modeled exhaust gas temp 400° – 880° C • Delta engine load< 20% • Exhaust gas mass flow 20 - 180 kg/h • Exhaust mass air integral 0.28 – 5.0 kg • Lambda control, 2nd lambda control, closed loop • O2S front, rear and heaters ready - no fault • Fuel cutoff, catalyst heating, SAI - not active • 1st lambda control loop not at min or max • 2nd lambda control loop active	• 120.0 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P219C Cylinder 1 Air-Fuel Ratio Imbalance	Cylinder 1 Air-Fuel Ratio Imbalance	• Individual cylinder fuel correction based on measured enleanment for dedicated engine roughness increase > 0.89	• Camshaft adjustment ready • Engine roughness signal valid • Engine speed 1,400 – 2,320 RPM • Engine load 39.80 – 90.00 % • Barometric pressure > 70.00 kPa • AAT > -20° C • ECT 50° – 108° C • Modeled catalyst temperature 450° – 750° C • Fuel adaptation completed • Electrical check of O2S completed • Lambda control closed loop • Homogeneous stochiometric active • Catalyst heating not active • EVAP purge loading < 0.30 - • Selected gear > = 6.00 • Rough road not active	• 20.0 s	• continuous • 2 DCY	– Check the Fuel Injector. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P219D Cylinder 2 Air-Fuel Ratio Imbalance	Cylinder 2 Air-Fuel Ratio Imbalance	• Individual cylinder fuel correction based on measured enleanment for dedicated engine roughness increase > 0.89	• Camshaft adjustment ready • Engine roughness signal valid • Engine speed 1,400 – 2,320 RPM • Engine load 39.80 – 90.00 % • Barometric pressure > 70.00 kPa • AAT > -20° C • ECT 50° – 108° C • Modeled catalyst temp. 450 – 750° C • Fuel adaptation completed • Electrical check of O2S completed • Lambda control closed loop • Homogeneous stochiometric active • Catalyst heating not active • EVAP purge loading < 0.30 - • Selected gear >= 6.00 • Rough road not active	• 20.0 s	• continuous • 2 DCY	– Check the Fuel Injector. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P219E Cylinder 3 Air-Fuel Ratio Imbalance	Cylinder 3 Air-Fuel Ratio Imbalance	• Individual cylinder fuel correction based on measured enleanment for dedicated engine roughness increase > 0.89	• Camshaft adjustment ready • Engine roughness signal valid • Engine speed 1,400 – 2,320 RPM • Engine load 39.80 – 90.00 % • Barometric pressure > 70.00 kPa • AAT > -20° C • ECT 50° – 108° C • Modeled catalyst temp. 450° – 750° C • Fuel adaptation completed • Electrical check of O2S completed • Lambda control closed loop • Homogeneous stochiometric active • Catalyst heating not active • EVAP purge loading < 0.30 - • Selected gear >= 6.00 • Rough road not active	• 20.0 s	• continuous • 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P219F Cylinder 4 Air-Fuel Ratio Imbalance	Cylinder 4 Air-Fuel Ratio Imbalance	• Individual cylinder fuel correction based on measured enleanment for dedicated engine roughness increase > 0.89	• Camshaft adjustment ready • Engine roughness signal valid • Engine speed 1,400 – 2,320 RPM • Engine load 39.80 – 90.00 % • Barometric pressure > 70.00 kPa • AAT > -20° C • ECT 50° – 108° C • Modeled catalyst temp. 450° – 750° C • Fuel adaptation completed • Electrical check of O2S completed • Lambda control closed loop • Homogeneous stochiometric active • Catalyst heating not active • EVAP purge loading < 0.30 - • Selected gear >= 6.00 • Rough road not active	• 20.0 s	• continuous • 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.8.19 uel Injectors, Checking", page 250 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2237 O2 Sensor Positive Current Control Circuit/Open Bank 1 Sensor 1	O2 Sensor Positive Current Control Circuit Open Bank 1, Sensor 1	• O2S signal front 1.49 - 1.50 V OR • O2S signal front < 1.70 V • Fuel cutoff < 3 sec. OR • O2S signal front 1.50 - 1.51 V • Delta lambda controller > 0.10	• O2S ceramic temp, 715° C • Lambda control, Closed loop • Mass air integral 0.8 kg • Lambda set value 0.97 - 1.03 • Electrical adjustment, Not active • Heater control active • EVAP purge valve ready, no fault • Lambda modulation > 0.02	• 1.5 – 5.0 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .
P2243 O2 Sensor Reference Voltage Circuit/ Open Bank 1 Sensor 1	O2 Sensor Reference Voltage Circuit Open Bank 1, Sensor 1	• O2S signal front < 0.30 V and Internal resistance > 1,000 Ohm • O2S signal front > 4.70 V and Internal resistance > 1,000 Ohm	• Heater control active	• 3.0 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .
P2251 O2 Sensor Negative Current Control Circuit/Open Bank 1 Sensor 1	O2 Sensor Negative Current Control Circuit Bank 1 Sensor 1 open	• O2S signal front 1.47 to 1.53 V • Internal resistance > 1,000 Ohm	• Modeled exhaust gas temp < 700° C • No fuel cutoff > 2.0 s • Heater control active	• 25.0 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .
P2257 AIR System Control "A" Circuit Low	Secondary Air Injection System Control Circuit Low	• Signal voltage 0.0 – 3.26 V	• Pump relay commanded off • Engine RPM > 80	• 0.5 s	• Continuous • 2 DCY	– Check the Secondary Air Injection Pump Relay -J299- / Secondary Air Injection Pump Motor - V101-. Refer to ⇒ S3.8.35 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking", page 283 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2263 Turbocharger/ Supercharger "A" Boost System Performance	Turbocharger Boost System Performance	• Signal voltage > 4,500 mV	---	• 0.5 s	• Continuous • 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.8.10 harge Air Pressure ActuatorV465 / Charge Air Pressure Actuator Position SensorG581, Checking", page 233 .
P2258 AIR System Control "A" Circuit High	Secondary Air Injection System Control Circuit High	• Signal current 0.60 – 2.40 A	• Pump relay commanded on • Engine RPM > 80	• 0.5 s	• Continuous • 2 DCY	– Check the Secondary Air Injection Pump Relay -J299- / Secondary Air Injection Pump Motor -V101-. Refer to ⇒ S3.8.35 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking", page 283 .
P2270 O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 2	O2 Sensor Signal Stuck Lean Bank 1 Sensor 2	• O2S signal rear < 0.63 V	• Mass air flow > 25 – 150 kg/h • Modeled exhaust gas temp > 350° C • O2 rear ready > 30 s • And • Closed loop	• 215.0 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2271 O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 2	O2 Sensor Signal Stuck Rich Bank 1 Sensor 2	• Sensor voltage of >= 0.15 V • After oxygen mass flow > 2,800 to 4,000 mg • Number of checks >= 1	• Time of fuel cutoff <= 90 s • Time after last fuel cutoff >=20 s • O2 rear ready • Exhaust temp at sensor >= 450° C • Oscillation check ready • Exhaust mass flow >= 12 kg/h • Sensor voltage at start of measurement > 0.55 V	• 10.0	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.8.31 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 273 .
P2279 MAP/MAF - Throttle Position Correlation	Intake Air System Leak	• Threshold to detect a defective system > 1.33 – 1.60	• Time after engine start > 60 s • Engine load < 40% • Mass air flow < 6,553.50 kg/h • ECT > 49.50° C • IAT < 99.80° C • Lambda control value > .95 • Lambda set value .95 – 1.05 • Vehicle speed < 1 km/h • Lambda control active • Engine speed - idle • Altitude < 2,700 m • O2S front - no fault	• 23.0 s	• 2 DCY	– Check for air leaks visually between MAF and throttle body, oil fill cap not seated or oil dipstick not seated in tube. Also any engine gaskets that can cause additional air to enter the crankcase can set this fault. If a vacuum leak or crankcase seal is the cause, the idle may be rough or unstable.
P2293 Fuel Pressure Regulator "B" Performance	Fuel Pressure Regulator 2 Performance	• Difference between target pressure vs actual pressure: > 1.50 MPa • OR • < -1.50 MPa	• Time after engine start 10 s	• 3.0 s	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2294 Fuel Pressure Regulator "A" Control Circuit/Open	Fuel Pressure Regulator 2 Control Circuit	• Signal voltage 1.4 – 3.2 V • OR • Signal pattern incorrect	• Fuel control valve, Commanded Off • Fuel pump, Commanded On	• 0.5 s	• 2 DCY	– Check the Fuel Pressure Regulator Valve - N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 .
P2295 Fuel Pressure Regulator "A" Control Circuit Low	Fuel Pressure Regulator 2 Control Circuit Low	• Signal voltage 1.4 – 3.2 V	• Fuel control valve, Commanded Off	• 0.5 s	• 2 DCY	– Check the Fuel Pressure Regulator Valve - N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 .
P2296 Fuel Pressure Regulator "B" Control Circuit High	Fuel Pressure Regulator 2 Control Circuit High	• Signal voltage > 3.2 V	• Fuel control valve, Commanded On	• 0.5 s	• 2 DCY	– Check the Fuel Pressure Regulator Valve - N276-. Refer to ⇒ F3.8.20 uel Pressure Regulator Valve N276, Checking", page 252 .
P2300 Ignition Coil "A" Primary Control Circuit Low	Ignition Coil A Primary Control Circuit Low	• Signal current > 24.0 mA	• Engine speed > 680 RPM	• 2.0 s	• 2 DCY	– Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .
P2301 Ignition Coil "A" Primary Control Circuit High	Ignition Coil A Primary Control Circuit High	• Signal voltage > 5.1 – 7.0 V	• Engine speed > 680 RPM	• 2.0 s	• 2 DCY	– Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .
P2303 Ignition Coil "B" Primary Control Circuit Low	Ignition Coil B Primary Control Circuit Low	• Signal current > 24.0 mA	• Engine speed > 680 RPM	• 2.0 s	• 2 DCY	– Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2304 Ignition Coil "B" Primary Control Circuit High	Ignition Coil B Primary Control Circuit High	• Signal voltage > 5.1 – 7.0 V	• Engine speed > 680 RPM	• 2.0 s	• 2 DCY	– Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .
P2306 Ignition Coil "C" Primary Control Circuit Low	Ignition Coil C Primary Control Circuit Low	• Signal current > 24.0 mA	• Engine speed > 680 RPM	• 2.0 s	• 2 DCY	– Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .
P2307 Ignition Coil "C" Primary Control Circuit High	Ignition Coil C Primary Control Circuit High	• Signal voltage > 5.1 – 7.0 V	• Engine speed > 680 RPM	• 2.0 s	• 2 DCY	– Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .
P2309 Ignition Coil "D" Primary Control Circuit Low	Ignition Coil D Primary Control Circuit Low	• Signal current > 24.0 mA	• Engine speed > 680 RPM	• 2.0 s	• 2 DCY	– Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .
P2310 Ignition Coil "D" Primary Control Circuit High	Ignition Coil D Primary Control Circuit High	• Signal voltage > 5.1 – 7.0 V	• Engine speed > 680 RPM	• 2.0 s	• 2 DCY	– Check the Ignition Coils with Power Output Stage. Refer to ⇒ I3.8.24 gnition Coils with Power Output Stage, Checking", page 259 .
P240A EVAP System Leak Detection Pump Heater Control Circuit/ Open	EVAP Leak Detection Pump Heater Circuit High	• Signal voltage > 4.7 – 5.4 V	• EVAP pump heater commanded off	• 0.5 s	• Continuous • 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P240B EVAP System Leak Detection Pump Heater Control Circuit Low	EVAP Leak Detection Pump Heater Circuit Low	• Signal voltage < 2.74 – 3.26 V	• EVAP pump heater commanded off	• 0.5 s	• Continuous • 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .
P240C EVAP System Leak Detection Pump Heater Control Circuit High	EVAP Leak Detection Pump Heater Circuit High	• Signal current > 2.2 – 4.0 A	• EVAP pump heater commanded on	• 0.5 s	• Continuous • 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .
P2400 EVAP System Leak Detection Pump Control Circuit/ Open	Evaporative Emission System Leak Detection Pump Control Circuit Open	• Signal voltage > 4.4 – 5.6 V	• LDP Commanded off • Engine speed, 80 RPM	• 0.5 s	• 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .
P2401 EVAP System Leak Detection Pump Control Circuit Low	Evaporative Emission System Leak Detection Pump Control Circuit Low	• Signal voltage > 2.15 – 3.25 V	• LDP Commanded Off • Engine speed, 80 RPM	• 0.5 s	• 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .
P2402 EVAP System Leak Detection Pump Control Circuit High	Evaporative Emission System Leak Detection Pump Control Circuit High	• Signal current > 3.0 A	• LDP Commanded On • Engine speed, 80 RPM	• 0.5 s	• 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2407 EVAP System Leak Detection Pump Sense Circuit Intermittent/ Erratic	EVAP Leak Detection Sense Circuit Intermittent	• Fluctuation of EVAP pump current during reference measurement > 3 mA or drop of pump current during pump phase > 6 mA for > = 3 s	• Time since engine start >= 600 s • Difference between ECT and IAT at start < = 6.8 K • ECT at start >= 4.0° C • Engine off time > 21,600 • Ambient air temp 4.0° - 35° C • Altitude < 2,700 m • Change in battery voltage during monitoring < 1.0 V • Engine off time > 5.0 s • Veh speed >= 0.0 km/h • Air bag not active	• 800.0 s .	• Once/DCY • 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .
P2414 O2 Sensor Exhaust Sample Error Bank 1 Sensor 1	O2 Sensor Exhaust Sample Error Bank 1 Sensor 1	• Threshold 1 • Signal voltage 3.1 – 4.81 V • O2S signal 2.5 – 3.2 V Threshold 2 • Signal voltage 2.5 V • O2S signal 2.5 – 3.1 V	• Lambda set value 1 • Fuel cut off, Not active • Heater control, closed loop • SAI not active • O2S ceramic temp > 715° C • If low fuel signal then wait > 600 s	• 15.0 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2421 EVAP System Vent Valve Stuck Open	EVAP System Vent Valve Stuck Open	• Change of EVAP pump current > 2.0 mA within >= 5.0 s	• Ambient air temp 4.0° – 35° C • Altitude < 2,700 m • Difference between ECT and AAT at start < 6.8 K • ECT 3.8° – 120° C • ECT at start 3.8° – 50.3° C • Time after engine start < 120 s • Veh. speed 0.0 to 80 km/h • Fuel tank isolation valve ready	• 110.6 s	• Once • 2 DCY	– Check the EVAP Canister Purge Regulator Valve 2 -N115-. Refer to ⇒ E3.8.15 VAP Canister Purge Regulator Valve 2 N115, Checking", page 242 .
P2422 EVAP System Vent Valve Stuck Closed	EVAP System Vent Valve Stuck Closed	• Change of EVAP pump current > 2.0 mA within > = 5.0 s	• Ambient air temp 4.0° – 35° C • Altitude < 2,700 m • Difference between ECT and AAT at start < 6.8 K • ECT 3.8° – 120° C • ECT at start 3.8° - 50.3° C • Time after engine start < 120 s • Veh. speed 0.0 – 80 km/h • Fuel tank isolation valve ready	• 110.6 s	• Once • 2 DCY	– Check the EVAP Canister Purge Regulator Valve 2 -N115-. Refer to ⇒ E3.8.15 VAP Canister Purge Regulator Valve 2 N115, Checking", page 242 .
P2431 AIR System Air Flow/ Pressure Sensor Circuit Range/ Performance Bank 1	Secondary Air System Pressure Sensor Circuit Performance	• Difference between AIR pressure and ambient pressure < -6.0 • OR • > 6.0 kPa	• AIR done	• 0.0 s	• Once • 2 DCY	– Check the Secondary Air System -GX24-. Refer to ⇒ S3.8.36 econdary Air SystemGX24, Checking", page 285 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2432 AIR System Air Flow/ Pressure Sensor Circuit Low Bank 1	Secondary Air System Pressure Sensor Circuit Low	• Signal voltage < 0.50 V	---	• 0.0 s	• Once • 2 DCY	– Check the Secondary Air System -GX24-. Refer to ⇒ S3.8.36 econdary Air SystemGX24, Checking", page 285 .
P2433 AIR System Air Flow/ Pressure Sensor Circuit High Bank 1	Secondary Air System Pressure Sensor Circuit High	• Signal voltage > 4.50 V	---	• 0.0 s	• Once • 2 DCY	– Check the Secondary Air System -GX24-. Refer to ⇒ S3.8.36 econdary Air SystemGX24, Checking", page 285 .
P2440 AIR System Switching Valve Stuck Open Bank 1	Secondary Air Pump Stuck On	• Blockage relative AIR pressure sensor vs. modeled leakage > = 0.59 kPa	• ECT between 5.0° – 108° C • IAT between 5.0° – 75° C • Modeled catalyst temp < 700° C • Mass air flow 7.0 – 55 kg/h • Altitude < 2,700 m • Engine speed > 80 RPM • Air system commanded off	• 0.0 s	• Once • 2 DCY	– Check the Secondary Air Injection Pump Relay -J299- / Secondary Air Injection Pump Motor -V101-. Refer to ⇒ S3.8.35 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking", page 283 .
P2450 EVAP System Switching Valve Performance/ Stuck Open	EVAP Switching Valve Performance/ Stuck Open	• EVAP pump current difference between reference measurement to idle >= 3.0 mA	• Engine OFF: • ECT > = 4° C	• 13.5 s	• Once/DCY • 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.8.27 eak Detection Pump V144, Checking", page 265 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Engine ON: • Time since engine start >= 600 s • Difference between ECT and IAT at start < = 6.8 K • Ambient air temp 4.0° – 35° C • Altitude < 2,700 m • Change in battery voltage during monitoring < 1.0 V • Engine off time > 5.0 s • Vehicle speed >= 0.0 km/h • Air bag not active	• 4.5 s		
P254F Engine Hood Switch Circuit	Engine Hood Switch Circuit	• Engine hood switch failure. Engine hood open.	• Vehicle speed > 27 MPH	• 5.0 s	• Continuous • 2 DCY	– Check engine hood switch. Refer to appropriate repair manual.
P2562 Turbocharger Boost Control Position Sensor "A" Circuit	Turbocharger Boost Control Position Sensor Circuit	• Signal voltage > 4745 mV	---	• 0.5 s	• Continuous • 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.8.10 harge Air Pressure ActuatorV465 / Charge Air Pressure Actuator Position SensorG581, Checking", page 233 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2563 Turbocharger Boost Control Position Sensor "A" Circuit Range/ Performance	Turbocharger Boost Control Position Sensor Circuit Performance	• Signal voltage > 4,500 mV	---	• 0.5 s	• Continuous • 2 DCY	– Check the Charge Air Pressure Actuator - V465- / Charge Air Pressure Actuator Position Sensor -G581-.. Refer to ⇒ C3.8.10 harge Air Pressure ActuatorV465 / Charge Air Pressure Actuator Position SensorG581, Checking”, page 233 .
P2564 Turbocharger Boost Control Position Sensor "A" Circuit Low	Turbocharger Boost Control Position Sensor Circuit Low	• Signal voltage < 255 mV	---	• 0.5 s	• Continuous • 2 DCY	– Check the Charge Air Pressure Actuator - V465- / Charge Air Pressure Actuator Position Sensor -G581-.. Refer to ⇒ C3.8.10 harge Air Pressure ActuatorV465 / Charge Air Pressure Actuator Position SensorG581, Checking”, page 233 .
P2600 Coolant Pump "A" Control Circuit/ Open	Coolant Pump Control Circuit Open	• Signal voltage 4.8 – 5.3 V	• Ignition on	• 0.5 s	• Continuous • 2 DCY	– Check the High Temperature Coolant Pump - V467-. Refer to ⇒ H3.8.23 igh Temperature Coolant Pump V467, Checking”, page 257 .
P2602 Coolant Pump "A" Control Circuit Low	Coolant Pump Control Circuit Low	• Signal voltage < 2.8 – 3.2 V	• Ignition on	• 0.5 s	• Continuous • 2 DCY	– Check the High Temperature Coolant Pump - V467-. Refer to ⇒ H3.8.23 igh Temperature Coolant Pump V467, Checking”, page 257 .
P2603 Coolant Pump "A" Control Circuit High	Coolant Pump Control Circuit High	• Signal current > 5.5 – 10 A	• Ignition on	• 0.5 s	• Continuous • 2 DCY	– Check the High Temperature Coolant Pump - V467-. Refer to ⇒ H3.8.23 igh Temperature Coolant Pump V467, Checking”, page 257 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P261A Coolant Pump "B" Control Circuit/ Open	Coolant Pump B Control Circuit Open	• Signal voltage 4.8 – 5.3 V	• Ignition on	• 0.5 s	• Continuous • 2 DCY	– Check the High Temperature Coolant Pump -V467-. Refer to ⇒ H3.8.23 igh Temperature Coolant Pump V467, Checking", page 257 .
P261C Coolant Pump "B" Control Circuit Low	Coolant Pump B Control Circuit Low	• Signal voltage < 2.8 – 3.2 V	• Ignition on • OR • ECM after running active	• 30.0 s	• Continuous • 2 DCY	– Check the High Temperature Coolant Pump -V467-. Refer to ⇒ H3.8.23 igh Temperature Coolant Pump V467, Checking", page 257 .
P261D Coolant Pump "B" Control Circuit High	Coolant Pump B Control Circuit High	• Signal current > 2.2 – 4.0 A	• Ignition on	• 0.5 s	• Continuous • 2 DCY	– Check the High Temperature Coolant Pump -V467-. Refer to ⇒ H3.8.23 igh Temperature Coolant Pump V467, Checking", page 257 .
P2626 O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor	O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	• O2S signal front > 4.81 V	• Modeled exhaust temp < 700° C • O2S ceramic temp, 715° C • Fuel cut off, Active • Heater control closed loop • No low fuel signal	• 1.5 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.8.32 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 276 .
P2705 Transmission Friction Element "F" Apply Time Range/ Performance	ECM: Electronic Throttle Control Module	• De-coupler status incorrect	---	• 0.5 s	• Continuous • 2 DCY	– Replace the Engine Control Module -J623-. Refer to appropriate service manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P30A2 Brake Pedal Range Sensor <=> Brake Light Switch Implausible Signal	Brake pedal range sensor or brake light switch Implausible signal	• Brake light switch not active and brake pedal position > 25% • OR • Brake light switch active and brake pedal position < 1.0%	---	• 0.0 s	• Continuous • 2 DCY	– Consult Appropriate Repair Manual for diagnosis and repair.
P30DC Pressure Release For Refueling Gas Tank Not Possible	Pressure Release For Refueling Gas Tank Not Possible	• EVAP system vapor pressure >= 3.8 kPa and time after refueling request >= 30 s	• EVAP system vapor pressure >= 3.8 kPa	• 30 s	• Once • 2 DCY	– Check for damaged, plugged or kinked EVAP lines. – Check the EVAP Canister Purge Regulator Valve 2 -N115-. Refer to ⇒ E3.8.15 VAP Canister Purge Regulator Valve 2 N115, Checking", page 242 . – Check the Fuel Tank Pressure Sensor -G400-. Refer to ⇒ F3.8.22 uel Tank Pressure Sensor G400, Checking", page 255 .
P3043 Fuel Pump "A" Control Circuit/ Open	Fuel pump mechanical malfunction - Locked pump	• Phase current > 17.0 A	• Engine speed > 80 RPM	• 20.0 s	• Continuous • 2 DCY	– Replace fuel pump. Refer to the appropriate repair manual.
P3045 Fuel Pump "A" Control Circuit/ Open	Fuel pump electronics Faulty	• Internal check failed	• Engine speed > 80 RPM	• 10.0 s	• Continuous • 2 DCY	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.8.17 uel Delivery UnitGX1 / Fuel Pump Control Module J538, Testing", page 246 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P308D Fuel Pump "A" Low Flow/ Performance	Fuel pump Engine speed too low	• Phase current > 23.0 A	• Engine speed > 80 RPM	• 10.0 s	• Continuous • 2 DCY	– Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.8.17 uel Delivery UnitGX1 / Fuel Pump Control Module J538, Testing", page 246 .
P308E Fuel Pump Control Module "A"	Fuel pump electronics Excess temperature	• Internal check failed	• Engine speed > 80 RPM	• 10.0 s	• Continuous • 2 DCY	– Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.8.17 uel Delivery UnitGX1 / Fuel Pump Control Module J538, Testing", page 246 .
P3081 Engine Temperature Too Low	Engine Temperature Too Low	• Difference between ECT and modeled ECT > 10 Kelvin	• Max reference temperature 60° C	• 4.0 s	• 2 DCY	– Check the Engine Coolant Temperature (ECT) Sensor - G62-. Refer to ⇒ E3.8.11 ngine Coolant Temperature SensorG62, Checking", page 235 . – Check for a stuck open thermostat. Refer to the Repair Manual.
P309D Clutch Disengagement Actuator Insufficient Slip With Disengaged Clutch	Clutch disengagement actuator insufficient slip with disengaged clutch	• Engine speed is detected while electronic clutch is open: > 0.0 RPM	• Electric drive - commanded ON • Electric clutch - opened		• Once • 1 DCY	– Consult Appropriate Repair Manual for diagnosis and repair.
P309F Engine Disconnect Clutch Excessive Slippage	Clutch disengagement actuator slip when clutch engaged	• Slip detection - difference between engine speed and drive motor: > 70 to 300 RPM	• Hybrid drive - commanded ON • Electric clutch - closed			– Consult Appropriate Repair Manual for diagnosis and repair.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0001 High Speed CAN Communication Bus	High Speed CAN Communication Bus	• Bus Off failure or CAN message = no feedback	• Time after ignition on 500 ms	• 250 ms	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ B3.8.7 us Terminal Resistance, Checking", page 227 .
U0002 High Speed CAN Communication Bus Performance	High Speed CAN Communication Bus Performance	• Global Time Out failure or receiving no messages	• Time after ignition on 500 ms	• 450 ms	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ B3.8.7 us Terminal Resistance, Checking", page 227 .
U0028 Vehicle Communication Bus A	Vehicle Communication Bus Fault	• CAN message = no feedback	• Time after ignition on > 500 ms.	• 0.25 s	• Continuous • 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ B3.8.7 us Terminal Resistance, Checking", page 227 .
U0029 Vehicle Communication Bus A Performance	Vehicle Communication Bus Performance	• Global time out - no messages received	• Time after ignition on > 500 ms	• 0.45 s	• Continuous • 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ B3.8.7 us Terminal Resistance, Checking", page 227 .
U0100 Lost Communication With ECM/PCM "A"	Lost Communication With ECM/PCM "A"	• CAN communication with Engine Control Module time out	• Battery state HV OFF • Or • Precharge • Or • HV_ON • Or • Emergency OFF	• 500 ms	• 2 DCY	– Refer to the appropriate Repair Manual for diagnosis and repair.
U0101 Lost Communication with TCM	Lost Communication with TCM	• Time Out failure. No message received by ECM	• Time after ignition on 500 ms	• 500 ms	• 2 DCY	– Check the CAN Bus terminal resistance, ABS Control Module - J104- to Engine Control Module - J623-. Refer to ⇒ T3.8.8 erminal Resistance, Powertrain, Checking", page 229 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0110 Lost Communication With Drive Motor Control Module "A"	Lost Communication With Drive Motor Control Module "A"	• CAN communication with Drive Motor Control Module time out	• Time after ignition on 500 ms	• 0.5 s	• 2 DCY	– Refer to the appropriate Repair Manual for diagnosis and repair.
U0111 Lost Communication With Battery Energy Control Module "A"	Lost Communication With Battery Energy Control Module "A"				• 1 DCY	– Refer to the appropriate Repair Manual for diagnosis and repair.
U0112 Lost Communication With Battery Energy Control Module "B"	Lost Communication With Battery Energy Control Module "B"	• CAN communication with Battery Energy Control Module time out	• Time after ignition on 500 ms	• 0.5 s	• 2 DCY	– Refer to the appropriate Repair Manual for diagnosis and repair.
U0121 Lost Communication With Anti-Lock Brake System (ABS) Control Module	Lost Communication With Anti-Lock Brake System (ABS) Control Module	• CAN communication with ABS Time Out.	• Time after ignition on 500 ms	• 0.5 s	• 2 DCY	– Check the CAN Bus terminal resistance. Refer to ABS Module - J104-. Refer to ⇒ T3.8.8 erminal Resistance, Powertrain, Checking", page 229 .
U0122 Lost Communication With Vehicle Dynamics Control Module	Lost Communication With Vehicle Dynamics Control Module			• 500 ms	• 2 DCY	– Refer to the appropriate Repair Manual for diagnosis and repair.
U0146 Lost Communication With Gateway "A"	Lost Communication With Gateway A	• CAN communication with gateway Time Out	• Time after ignition on 500 ms	• 500 ms	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.8.8 erminal Resistance, Powertrain, Checking", page 229 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0155 Lost Communication With Instrument Panel Cluster (IPC) Control Module	Lost Communication With Instrument Panel Cluster (IPC) Control Module	• No IPC CAN messages received	• Time after ignition on 500 ms	• 2,000 ms	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.8.8 erminal Resistance, Powertrain, Checking", page 229 . – Check IPC communication with a scan tool. If no IPC communication with scan tool and all other modules communicate, check IPC power and grounds. If OK, replace IPC Module.
U0302 Software Incompatibility With Transmission Control Module	Software Incompatibility with Transmission Control Module	• AT vehicle ECM coded as MT vehicle	• Time after ignition on 500 ms	• 5,000 ms	• 2 DCY	– Check for correct software in ECM. If software is incorrect (manual transmission calibration on automatic trans vehicle), reflash ECM with correct software.
U0401 Invalid Data Received From ECM/PCM "A"	Invalid Data Received From ECM/PCM "A"	• Received data implausible message	• Battery state HV OFF • Or • Precharge • Or • HV_ON • Or • Emergency OFF	• 500 ms	• 2 DCY	– Refer to the appropriate Repair Manual for diagnosis and repair.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0402 Invalid Data Received From TCM	Invalid Data Received From Transmission Control Module	• Transmission Data Length Code incorrect	• Time after ignition on 500 ms	• 60.0 ms	• 2 DCY	– VIN or application error (software). Check VIN and calibration number in TCM module for correct data. Reflash module with correct VIN or calibration. If code persists make sure all power and grounds to the TCM are present. If OK, replace the TCM. Refer to the Repair Manual.
U0411 Invalid Data Received From Drive Motor Control Module "A"	CAN: DMCM (Drive Motor Control Module)	• Received data implausible message	• Time after ignition on 500 ms	• 2.5 s	• 2 DCY	– Refer to the appropriate Repair Manual for diagnosis and repair.
U0412 Invalid Data Received From Battery Energy Control Module "A	Invalid Data Received From Battery Energy Control Module "A"	• Received data implausible message			• 1 DCY	– Refer to the appropriate Repair Manual for diagnosis and repair.
U0413 Invalid Data Received From Battery Energy Control Module "B"	CAN: BECM (Battery Energy Control Module	• Received data implausible message	• Time after ignition on 500 ms	• 2.5 s	• 2 DCY	– Refer to the appropriate Repair Manual for diagnosis and repair.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0415 Invalid Data Received From Anti-Lock Brake System (ABS) Control Module	Invalid Data Received From Anti-Lock Brake System Control Module	• Speed sensor initialization failed • Speed sensor low voltage error failed • Speed sensor error failed • Implausible message	• Time after ignition on 500 ms • Battery voltage > 9.5 V • Battery voltage < 16.0 V	• 480 - 2,100 ms	• 2 DCY	– May have vehicle speed error. Using a scan tool, check for correct vehicle speed reading from wheel sensors in ABS module. If an ABS communication fault exists: – Check the CAN Bus to ABS Module -J104-. Refer to ⇒ T3.8.8 erminal Resistance, Powertrain, Checking", page 229 .
U0416 Invalid Data Received From Vehicle Dynamics Control Module	Invalid Data Received From Vehicle Dynamics Control Module	• Received data implausible message			• 2 DCY	– Refer to the appropriate Repair Manual for diagnosis and repair.
U0422 Invalid Data Received From Body Control Module	Invalid Data Received From Body Control Module (Cluster)	• Ambient temperature value initialization failure.	• Status ambient temperature from instrument cluster no fault • Electrical check ambient temperature sensor no fault	• 2.0 s	• 2 DCY	– Refer to the appropriate electrical manual for proper diagnosis for the: Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.8.30 utside Air Temperature Sensor G17, Checking", page 271 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0423 Invalid Data Received From Instrument Panel Cluster Control Module	Invalid Data Received From Instrument Panel Cluster Control Module	• Implausible CAN messages received. • Implausible ambient temperature value	• No ambient temperature faults set in instrument cluster module. • Key on.	• 3,000 ms -3.0 s	• 2 DCY	– VIN or application error (software). Check VIN and calibration number in Instrument Cluster Module. Refer to the Repair Manual for Instrument Cluster diagnosis and reflash procedure. Ambient temperature sensor may out of range. Refer to the appropriate electrical manual for proper diagnosis for the: Outside Air Temperature Sensor - G17-. Refer to ⇒ O3.8.30 utside Air Temperature Sensor G17, Checking", page 271 .
U0447 Invalid Data Received From Gateway "A"	Lost Communication With Gateway	• CAN message incorrect or implausible	---	• 0.5 s	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ B3.8.7 us Terminal Resistance, Checking", page 227 .
U1103 Control Module Vehicle Options Error	Vehicle In Production Mode	• Production mode active	• During ECM keep alive time after ignition off • Vehicle speed < 5.0 km/h • Engine speed 0.0 RPM • Max trip mileage since first vehicle startup < 100 km/h • Drive motor off	• 0.0 s	• 1 DCY	– Vehicle in production mode. Refer to appropriate repair manual for resolution. Note the mode can be deactivated with a factory scan tool or will automatically turn off after vehicle accumulates the first 100 km (62.14 miles) of driving.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U1106 Customer Service Mode Active	Vehicle In Service Mode	• HEV service mode active	• During ECM keep alive time after ignition off • Vehicle speed < 0.0 km/h • Engine speed 0.0 RPM • Drive motor off	• 0.0s	• 1 DCY	– Vehicle is in Customer Service Mode. Refer to appropriate repair manual for resolution. Note the mode can be deactivated with a factory scan tool or will automatically turn off after vehicle accumulates the first 100 km (62.14 miles) of driving. May need to perform readiness check. Refer to ⇨ C3.2 ode ", page 21 .

3.5 Battery DTC Table

3.5.1 Battery Regulation Control Module, 2013-2014 MY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0604 Internal Control Module Random Access Memory (RAM) Error	Internal Control Module Random Access Memory (RAM) Error	• RAM test inconsistency	• Battery state INIT	• Immediately	• 1 DCY
P0606 Control Module Processor	Control Module Processor	• A/D conversion timeout > 100 µs • A/D converter value < 2.5 * 0.9 V • A/D converter value > 2.5 * 1.1 V • A/D converter value < 4.096 * 0.9 V • A/D converter value > 4.096 * 1.1 V • All multiplexed values at the internal AD converter are equal	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON, • Or • EMERGENCY_OFF	• 0.20 s	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P062F Internal Control Module EEPROM Error	Internal Control Module EEPROM Error	• ROM test inconsistency • NVM test inconsistency	• Battery state INIT • HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• Immediately	• 1 DCY
P0A1F Battery Energy Control Module "A" Performance	Battery Energy Control Module	• AD converter current value (reference check) > 6.0 A • Or • AD converter current value (offset check) > 3.115 A • Or • All multiplexed values at the external AD converter are equal	• Battery state INIT • HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.10 s • Or • Immediately • Or • 0.20 s • OR • 0.05 s	• 1 DCY
		• Compare written date with read out date of drive CAN controller inconsistency • Or • Compare written date with read out date of hybrid CAN controller inconsistency			
		• DATA00 < 20% • Or • DATA00 > 80% • Or • DATA00 > 30% • OR • DATA00 < 70%			
		• Contactor power circuit status inconsistency			

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0A80 Replace Hybrid/EV Battery Pack	Replace Hybrid/EV Battery Pack	• Ratio U/I <= 0.308 … 2.766 V/A	• Battery state: HV_ON • Battery temperature > -20° C • And • Battery temperature < 55° C • And • Battery state of charge > 20% • And • Battery state of charge < 80%	• 5 times	• 2 DCY
P0A95 High Voltage Fuse "A"	High Voltage Fuse "A"	• State 0: all contactors off (INIT Mode) invalid • State 1: all contactors off (after INIT Mode) invalid • State 2: control negative contactor to close invalid • State 3: control precharge contactor to close invalid • State 4: control positive contactor to close invalid • State 5: control precharge contactor to open invalid • State 6: control negative contactor to open invalid	• Battery state INIT, and PRECHARGE		• 1 DCY
		• Negative battery voltage < 0.5 * negative pack voltage V • And • Battery current < 100.0 mA	• Battery state HV_ON • Or • PRECHARGE	• 1.20 s	

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0A9C Hybrid/EV Battery Temperature Sensor "A" Circuit Range/Performance	Hybrid/EV Battery Temperature Sensor "A" Circuit Range/Performance	• Temperature sensor - average temperature > 20° C • Or • Average temperature - temperature sensor > 20° C	• Battery state HV_OFF, or PRECHARGE, or HV_ON, or EMERGENCY_OFF	• 0.90 s.	• 2 DCY
P0A9D Hybrid/EV Battery Temperature Sensor "A" Circuit Low	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	• Temperature sensor > 94° C • Temperature sensor < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.60 s	• 2 DCY
P0A9E Hybrid/EV Battery Temperature Sensor "A" Circuit High	Hybrid/EV Battery Temperature Sensor "A" Circuit High	• Temperature sensor > 94° C • Temperature sensor < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.60 s	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0AA1 Hybrid/EV Battery Positive Contactor Circuit Stuck Closed	Hybrid/EV Battery Positive Contactor Circuit Stuck Closed	• State 0: all contactors off (INIT Mode) invalid • State 1: all contactors off (after INIT Mode) invalid • State 2: control negative contactor to close invalid • State 3: control precharge contactor to close invalid • State 4: control positive contactor to close invalid • State 5: control precharge contactor to open invalid • State 6: control negative contactor to open invalid	• Battery state INIT • And • PRECHARGE		• 1 DCY
P0AA2 Hybrid/EV Battery Positive Contactor Circuit Stuck Open	Hybrid/EV Battery Positive Contactor Circuit Stuck Open	• State 0: all contactors off (INIT Mode) invalid • State 1: all contactors off (after INIT Mode) invalid • State 2: control negative contactor to close invalid • State 3: control precharge contactor to close invalid • State 4: control positive contactor to close invalid • State 5: control precharge contactor to open invalid • State 6: control negative contactor to open invalid	• Battery state INIT • And • PRECHARGE		• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0AA4 Hybrid/ EV Battery Negative Contactor Circuit Stuck Closed	Hybrid/EV Battery Negative Contactor Circuit Stuck Closed	• State 0: all contactors off (INIT Mode) invalid • State 1: all contactors off (after INIT Mode) invalid • State 2: control negative contactor to close invalid • State 3: control precharge contactor to close invalid • State 4: control positive contactor to close invalid • State 5: control precharge contactor to open invalid • State 6: control negative contactor to open invalid	• Battery state INIT • And • PRECHARGE		• 1 DCY
P0AA5 Hybrid/ EV Battery Negative Contactor Circuit Stuck Open	Hybrid/EV Battery Negative Contactor Circuit Stuck Open	• State 0: all contactors off (INIT Mode) invalid • State 1: all contactors off (after INIT Mode) invalid • State 2: control negative contactor to close invalid • State 3: control precharge contactor to close invalid • State 4: control positive contactor to close invalid • State 5: control precharge contactor to open invalid • State 6: control negative contactor to open invalid	• Battery state INIT • And • PRECHARGE		• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0AAD Hybrid/EV Battery Pack Air Temperature Sensor "A" Circuit Range/Performance	Hybrid/EV Battery Pack Air Temperature Sensor "A" Circuit Range/Performance	• Inlet temperature - average temperature > 10° C • Or • Average temperature - inlet temperature > 10° C • Outlet temperature - average temperature > 10° C • Or • Average temperature - outlet temperature > 10° C • •	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON, EMERGENCY_OFF • And • Engine off time (battery cool down) > 480.0 min	• 0.90 s	• 2 DCY
P0AAE Hybrid/EV Battery Pack Air Temperature Sensor "A" Circuit Low	Hybrid/EV Battery Pack Air Temperature Sensor "A" Circuit Low	• Inlet temperature > 94° C • Outlet temperature > 94° C • Inlet temperature < -44° C • Outlet temperature < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON, EMERGENCY_OFF •	• 0.60 s	• 2 DCY
P0AAF Hybrid/EV Battery Pack Air Temperature Sensor "A" Circuit High	Hybrid/EV Battery Pack Air Temperature Sensor "A" Circuit High	• Inlet temperature > 94° C • Outlet temperature > 94° C • Inlet temperature < -44° C • Outlet temperature < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON, EMERGENCY_OFF	• 0.60 s	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0AB2 Hybrid/EV Battery Pack Air Temperature Sensor "B" Circuit Range/Performance	Hybrid/EV Battery Pack Air Temperature Sensor "B" Circuit Range/Performance	• Inlet temperature - average temperature > 10° C • Or • Average temperature - inlet temperature > 10° C • Outlet temperature - average temperature > 10° C • Or • Average temperature - outlet temperature > 10° C • •	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON, EMERGENCY_OFF • And • Engine off time (battery cool down) > 480.0 min	• 0.90 s	• 2 DCY
P0AB3 Hybrid/EV Battery Pack Air Temperature Sensor "B" Circuit Low	Hybrid/EV Battery Pack Air Temperature Sensor "B" Circuit Low	• Inlet temperature > 94° C • Outlet temperature > 94° C • Inlet temperature < -44° C • Outlet temperature < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON, EMERGENCY_OFF	• 0.60 s	• 2 DCY
P0AB4 Hybrid/EV Battery Pack Air Temperature Sensor "B" Circuit High	Hybrid/EV Battery Pack Air Temperature Sensor "B" Circuit High	• Inlet temperature > 94° C • Outlet temperature > 94° C • Inlet temperature < -44° C • Outlet temperature < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON, EMERGENCY_OFF	• 0.60 s	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0ABA Hybrid/EV Battery Pack Voltage Sense "A" Circuit	Hybrid/EV Battery Pack Voltage Sense "A" Circuit	• Cell controller communication is missing at least one cell controller inconsistency • Or • ID or Number of cell inconsistency • Or • The status of cell controller is abnormal inconsistency	• Battery state HV_OFF, • Or • PRECHARGE, • Or • HV_ON, EMERGENCY_OFF	• 0.70 s • 2.0 counts • 0.50 s.	• 1 DCY
P0ABB Hybrid/EV Battery Pack Voltage Sense "A" Circuit Range/Performance	Hybrid/EV Battery Pack Voltage Sense "A" Circuit Range/Performance	• State 0: all contactors off (INIT Mode) invalid • State 1: all contactors off (after INIT Mode) invalid • State 2: control negative contactor to close invalid • State 3: control precharge contactor to close invalid • State 4: control positive contactor to close invalid • State 5: control precharge contactor to open invalid • State 6: control negative contactor to open invalid	• Battery state INIT • And • PRECHARGE		• 1 DCY
P0ABC Hybrid/EV Battery Pack Voltage Sense "A" Circuit Low	Hybrid/EV Battery Pack Voltage Sense "A" Circuit Low	• Negative contactor voltage > 258.0 V • Or • Negative contactor voltage < -258.0 V • Or • Positive contactor voltage > 25.08 V • Or • Positive contactor voltage < -258.0 V	• Battery state HV_ON.	• 0.10 s	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0ABD Hybrid/EV Battery Pack Voltage Sense "A" Circuit High	Hybrid/EV Battery Pack Voltage Sense "A" Circuit High	• Negative contactor voltage > 258.0 V • Or • Negative contactor voltage < -258.0 V • Or • Positive contactor voltage > 258.0 V • Or • Positive contactor voltage < -25.08 V	• Battery state HV_ON.	• 0.10 s	• 2 DCY
P0AC0 Hybrid/EV Battery Pack Current Sensor "A" Circuit Range/Performance	Hybrid/EV Battery Pack Current Sensor "A" Circuit Range/Performance	• State 0: all contactors off (INIT Mode) invalid • State 1: all contactors off (after INIT Mode) invalid • State 2: control negative contactor to close invalid • State 3: control precharge contactor to close invalid • State 4: control positive contactor to close invalid • State 5: control precharge contactor to open invalid • State 6: control negative contactor to open invalid	• Battery state INIT • And • PRECHARGE		• 1 DCY
P0AC1 Hybrid/EV Battery Pack Current Sensor "A" Circuit Low	Hybrid/EV Battery Pack Current Sensor "A" Circuit Low	• Battery current < -245.0 A	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.10 s	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0AC2 Hybrid/EV Battery Pack Current Sensor "A" Circuit High	Hybrid/EV Battery Pack Current Sensor "A" Circuit High	• Battery current > 245.0 A	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.10 s	• 1 DCY
P0AC6 Hybrid/EV Battery Temperature Sensor "B" Circuit Range/Performance	Hybrid/EV Battery Temperature Sensor "B" Circuit Range/Performance	• Temperature sensor - average temperature > 20° C • Or • Average temperature - temperature sensor > 20° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.90 s	• 2 DCY
P0AC7 Hybrid/EV Battery Temperature Sensor "B" Circuit Low	Hybrid/EV Battery Temperature Sensor "B" Circuit Low	• Temperature sensor > 94° C • Temperature sensor < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.60 s	• 2 DCY
P0AC8 Hybrid/EV Battery Temperature Sensor "B" Circuit High	Hybrid/EV Battery Temperature Sensor "B" Circuit High	• Temperature sensor > 94° C • Temperature sensor < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.60 s	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0ACB Hybrid/EV Battery Temperature Sensor "C" Circuit Range/Performance	Hybrid/EV Battery Temperature Sensor "C" Circuit Range/Performance	• Temperature sensor - average temperature > 20° C • Or • Average temperature - temperature sensor > 20° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.90 s	• 2 DCY
P0ACC Hybrid/EV Battery Temperature Sensor "C" Circuit Low	Hybrid/EV Battery Temperature Sensor "C" Circuit Low	• Temperature sensor > 94° C • Temperature sensor < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.60 s	• 2 DCY
P0ACD Hybrid/EV Battery Temperature Sensor "C" Circuit High	Hybrid/EV Battery Temperature Sensor "C" Circuit High	• Temperature sensor > 94° C • Temperature sensor < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.60 s	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0AE2 Hybrid/EV Battery Precharge Contactor Circuit Stuck Closed	Hybrid/EV Battery Precharge Contactor Circuit Stuck Closed	• State 0: all contactors off (INIT Mode) invalid • State 1: all contactors off (after INIT Mode) invalid • State 2: control negative contactor to close invalid • State 3: control precharge contactor to close invalid • State 4: control positive contactor to close invalid • State 5: control precharge contactor to open invalid • State 6: control negative contactor to open invalid	• Battery state INIT • And • PRECHARGE		• 1 DCY
P0AE3 Hybrid/EV Battery Precharge Contactor Circuit Stuck Open	Hybrid/EV Battery Precharge Contactor Circuit Stuck Open	• State 0: all contactors off (INIT Mode) invalid • State 1: all contactors off (after INIT Mode) invalid • State 2: control negative contactor to close invalid • State 3: control precharge contactor to close invalid • State 4: control positive contactor to close invalid • State 5: control precharge contactor to open invalid • State 6: control negative contactor to open invalid	• Battery state INIT • And • PRECHARGE		• 1 DCY
		• Total cell voltage - contactor voltage > 10 V	• Battery state PRECHARGE	• 0.55 s	

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0AE9 Hybrid/EV Battery Temperature Sensor "D" Circuit Range/Performance	Hybrid/EV Battery Temperature Sensor "D" Circuit Range/Performance	• Temperature sensor - average temperature > 20° C • Or • Average temperature - temperature sensor > 20° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.90 s	• 2 DCY
P0AEA Hybrid/EV Battery Temperature Sensor "D" Circuit Low	Hybrid/EV Battery Temperature Sensor "D" Circuit Low	• Temperature sensor > 94° C • Temperature sensor < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.60 s	• 2 DCY
P0AEB Hybrid/EV Battery Temperature Sensor "D" Circuit High	Hybrid/EV Battery Temperature Sensor "D" Circuit High	• Temperature sensor > 94° C • Temperature sensor < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.60 s	• 2 DCY
P0AF8 Hybrid/EV Battery System Voltage	Hybrid/EV Battery System Voltage	• Total contactor voltage < 60.0 V • And • Battery current > 200.0 A • Or • Battery current > 11.40 A	• Battery state HV_ON, INIT, PRECHARGE	• 5.0 s • 0.10 s	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0B15 Hybrid/EV Battery Pack Voltage Sense "B" Circuit Range/Performance	Hybrid/EV Battery Pack Voltage Sense "B" Circuit Range/Performance	• State 0: all contactors off (INIT Mode) invalid • State 1: all contactors off (after INIT Mode) invalid • State 2: control negative contactor to close invalid • State 3: control precharge contactor to close invalid • State 4: control positive contactor to close invalid • State 5: control precharge contactor to open invalid • State 6: control negative contactor to open invalid	• Battery state INIT • And • PRECHARGE		• 1 DCY
P0B16 Hybrid/EV Battery Pack Voltage Sense "B" Circuit Low	Hybrid/EV Battery Pack Voltage Sense "B" Circuit Low	• Negative contactor voltage > 258.0 V • Or • Negative contactor voltage < -258.0 V • Or • Positive contactor voltage > 258.0 V • Or • Positive contactor voltage < -258.0 V	• Battery state HV_ON.	• 0.10 s	• 2 DCY
P0B17 Hybrid/EV Battery Pack Voltage Sense "B" Circuit High	Hybrid/EV Battery Pack Voltage Sense "B" Circuit High	• Negative contactor voltage > 258.0 V • Or • Negative contactor voltage < -258.0 V • Or • Positive contactor voltage > 258.0 V • Or • Positive contactor voltage < -258.0 V	• Battery state HV_ON.	• 0.10 s	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0B3C Hybrid/EV Battery Voltage Sense "A" Circuit Range/Performance	Hybrid/EV Battery Voltage Sense "A" Circuit Range/Performance	• Cell voltage [1 – 60] - average block voltage [1 – 8] > 300.0 mV	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF • Battery current < 5.0 A	• 1.10 s	• 2 DCY
P0B3D Hybrid/EV Battery Voltage Sense "A" Circuit Low	Hybrid/EV Battery Voltage Sense "A" Circuit Low	• Cell voltage < 1.90 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY
P0B3E Hybrid/EV Battery Voltage Sense "A" Circuit High	Hybrid/EV Battery Voltage Sense "A" Circuit High	• Cell voltage > 4.30 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY
P0B41 Hybrid/EV Battery Voltage Sense "B" Circuit Range/Performance	Hybrid/EV Battery Voltage Sense "B" Circuit Range/Performance	• Cell voltage [1 – 60] - average block voltage [1 – 8] > 300.0 mV	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF • Battery current < 5.0 A	• 1.10 s	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0B42 Hybrid/EV Battery Voltage Sense "B" Circuit Low	Hybrid/EV Battery Voltage Sense "B" Circuit Low	• Cell voltage < 1.90 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY
P0B43 Hybrid/EV Battery Voltage Sense "B" Circuit High	Hybrid/EV Battery Voltage Sense "B" Circuit High	• Cell voltage > 4.30 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY
P0B46 Hybrid/EV Battery Voltage Sense "C" Circuit Range/Performance	Hybrid/EV Battery Voltage Sense "C" Circuit Range/Performance	• Cell voltage [1 – 60] - average block voltage [1 – 8] > 300.0 mV	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF • Battery current < 5.0 A	• 1.10 s	• 2 DCY
P0B47 Hybrid/EV Battery Voltage Sense "C" Circuit Low	Hybrid/EV Battery Voltage Sense "C" Circuit Low	• Cell voltage < 1.90 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0B48 Hybrid/EV Battery Voltage Sense "C" Circuit High	Hybrid/EV Battery Voltage Sense "C" Circuit High	• Cell voltage > 4.30 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY
P0B4B Hybrid/EV Battery Voltage Sense "D" Circuit Range/Performance	Hybrid/EV Battery Voltage Sense "D" Circuit Range/Performance	• Cell voltage [1 – 60] - average block voltage [1 – 8] > 300.0 mV	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF • Battery current < 5.0 A	• 1.10 s	• 2 DCY
P0B4C Hybrid/EV Battery Voltage Sense "D" Circuit Low	Hybrid/EV Battery Voltage Sense "D" Circuit Low	• Cell voltage < 1.90 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY
P0B4D Hybrid/EV Battery Voltage Sense "D" Circuit High	Hybrid/EV Battery Voltage Sense "D" Circuit High	• Cell voltage > 4.03 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0B50 Hybrid/EV Battery Voltage Sense "E" Circuit Range/Performance	Hybrid/EV Battery Voltage Sense "E" Circuit Range/Performance	• Cell voltage [1 – 60] - average block voltage [1 – 8] > 300.0 mV	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF • Battery current < 5.0 A	• 1.10 s	• 2 DCY
P0B51 Hybrid/EV Battery Voltage Sense "E" Circuit Low	Hybrid/EV Battery Voltage Sense "E" Circuit Low	• Cell voltage < 1.09 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY
P0B52 Hybrid/EV Battery Voltage Sense "E" Circuit High	Hybrid/EV Battery Voltage Sense "E" Circuit High	• Cell voltage > 4.30 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY
P0B55 Hybrid/EV Battery Voltage Sense "F" Circuit Range/Performance	Hybrid/EV Battery Voltage Sense "F" Circuit Range/Performance	• Cell voltage [1 – 60] - average block voltage [1 – 8] > 300.0 mV	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF • Battery current < 5.0 A	• 1.10 s	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0B56 Hybrid/EV Battery Voltage Sense "F" Circuit Low	Hybrid/EV Battery Voltage Sense "F" Circuit Low	• Cell voltage < 1.90 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY
P0B57 Hybrid/EV Battery Voltage Sense "F" Circuit High	Hybrid/EV Battery Voltage Sense "F" Circuit High	• Cell voltage > 4.30 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY
P0B5A Hybrid/EV Battery Voltage Sense "G" Circuit Range/Performance	Hybrid/EV Battery Voltage Sense "G" Circuit Range/Performance	• Cell voltage [1 – 60] - average block voltage [1 – 8] > 300.0 mV	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF • Battery current < 5.0 A	• 1.10 s	• 2 DCY
P0B5B Hybrid/EV Battery Voltage Sense "G" Circuit Low	Hybrid/EV Battery Voltage Sense "G" Circuit Low	• Cell voltage < 1.90 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0B5C	Hybrid/EV Battery Voltage Sense "G" Circuit High	• Cell voltage > 4.30 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY
P0B5F Hybrid/EV Battery Voltage Sense "G" Circuit High	Hybrid/EV Battery Voltage Sense "H" Circuit Range/Performance	• Cell voltage [1 – 60] - average block voltage [1 – 8] > 300.0 mV	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF • Battery current < 5.0 A	• 1.10 s	• 2 DCY
P0B60 Hybrid/EV Battery Voltage Sense "H" Circuit Low	Hybrid/EV Battery Voltage Sense "H" Circuit Low	• Cell voltage < 1.90 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY
P0B61 Hybrid/EV Battery Voltage Sense "H" Circuit High	Hybrid/EV Battery Voltage Sense "H" Circuit High	• Cell voltage > 4.30 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1.0 s	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0BC3 Hybrid/EV Battery Temperature Sensor "E" Circuit Range/Performance	Hybrid/EV Battery Temperature Sensor "E" Circuit Range/Performance	• Temperature sensor - average temperature > 20° C • Or • Average temperature - temperature sensor > 20° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.90 s	• 2 DCY
P0BC4 Hybrid/EV Battery Temperature Sensor "E" Circuit Low	Hybrid/EV Battery Temperature Sensor "E" Circuit Low	• Temperature sensor > 94° C • Temperature sensor <-44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.60 s	• 2 DCY
P0BC5 Hybrid/EV Battery Temperature Sensor "E" Circuit High	Hybrid/EV Battery Temperature Sensor "E" Circuit High	• Temperature sensor > 94° C • Temperature sensor < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.60 s	• 2 DCY
P0BC8 Hybrid/EV Battery Pack Cooling Fan 1 Sense Range/Performance	Hybrid/EV Battery Pack Cooling Fan 1 Sense Range/Performance	• Fan feedback voltage > 1.37 – 3.43 V • Or • Fan feedback voltage < 0.00 – 1.04 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF • And • Fan duty cycle >= 20%	• 30.0 s	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0BC9 Hybrid/ EV Battery Pack Cooling Fan 1 Sense Circuit Low	Hybrid/EV Battery Pack Cooling Fan 1 Sense Circuit Low	• Fan feedback voltage < 0.10 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF • And • Fan duty cycle >= 20%	• 10.0 s	• 2 DCY
P0BCA Hybrid/ EV Battery Pack Cooling Fan 1 Sense Circuit High	Hybrid/EV Battery Pack Cooling Fan 1 Sense Circuit High	• Fan feedback voltage > 3.45 V	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF • And • Fan duty cycle >= 20%	• 10.0 s	• 2 DCY
P0C34 Hybrid/ EV Battery Temperature Sensor "F" Circuit Range/ Performance	Hybrid/EV Battery Temperature Sensor "F" Circuit Range/ Performance	• Temperature sensor - average temperature > 20° C • Or • Average temperature - temperature sensor > 20° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.90 s	• 2 DCY
P0C35 Hybrid/ EV Battery Temperature Sensor "F" Circuit Low	Hybrid/EV Battery Temperature Sensor "F" Circuit Low	• Temperature sensor > 94° C • Temperature sensor < -44° C	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.60 s	• 2 DCY
P0C36	Hybrid/EV Battery Tem-	• Temperature sensor > 94° C	• Battery state HV_OFF	• 0.60 s	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
Hybrid/EV Battery Temperature Sensor "F" Circuit High	perature Sensor "F" Circuit High	• Temperature sensor < -44° C	• Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF		
P0DAC Hybrid/EV Battery Cell Balancing Circuit "A"	Hybrid/EV Battery Cell Balancing Circuit "A"	• Vol_block Controller No - Σ cell controller voltages Cell No for 7 cells >= 8,295 V • Vol_block Controller No - Σ cell controller voltages Cell No for 8 cells >= 9,480 V • Or • Cell voltage Cell No > 4.90 V • Or • Cell voltage Cell No < 1.0 V • Or • Block voltage controller No > 49.0 V • Or • Block voltage controller No < 10.0 V • Or • Cell voltage Cell No – 1.85 V > 0.80 V • Cell No : cell number 0 – 59	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.90 s • Immediately	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0DB0 Hybrid/EV Battery Cell Balancing Circuit "B"	Hybrid/EV Battery Cell Balancing Circuit "B"	• Vol_block Controller No - Σ cell controller voltages Cell No for 7 cells >= 8,295 V • Vol_block Controller No - Σ cell controller voltages Cell No for 8 cells >= 9,480 V • Or • Cell voltage Cell No > 4.90 V • Or • Cell voltage Cell No < 1.0 V • Or • Block voltage controller No > 49.0 V • Or • Block voltage controller No < 10.0 V • Or • Cell voltage Cell No – 1.85 V > 0.8 V • Cell No : cell number 0 – 59	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.90 s • Immediately	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0DB4 Hybrid/EV Battery Cell Balancing Circuit "C"	Hybrid/EV Battery Cell Balancing Circuit "C"	• Vol_block Controller No - Σ cell controller voltages Cell No for 7 cells >= 8,295 V • Vol_block Controller No - Σ cell controller voltages Cell No for 8 cells >= 9,480 V • Or • Cell voltage Cell No > 4.90 V • Or • Cell voltage Cell No < 1.0 V • Or • Block voltage controller No > 49.0 V • Or • Block voltage controller No < 10.0 V • Or • Cell voltage Cell No – 1.85 V > 0.8 V • Cell No : cell number 0 – 59	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.90 s • Immediately	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0DB8 Hybrid/EV Battery Cell Balancing Circuit "D"	Hybrid/EV Battery Cell Balancing Circuit "D"	• Vol_block Controller No - Σ cell controller voltages Cell No for 7 cells >= 8,295 V • Vol_block Controller No - Σ cell controller voltages Cell No for 8 cells >= 9,480 V • Or • Cell voltage Cell No > 4.9 V • Or • Cell voltage Cell No < 1.0 V • Or • Block voltage controller No > 49.0 V • Or • Block voltage controller No < 10.0 V • Or • Cell voltage Cell No – 1.85 V > 0.8 V • Cell No : cell number 0 – 59	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.90 s • Immediately	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0DBC Hybrid/EV Battery Cell Balancing Circuit "E"	Hybrid/EV Battery Cell Balancing Circuit "E"	• Vol_block Controller No - Σ cell controller voltages Cell No for 7 cells >= 8,295 V • Vol_block Controller No - Σ cell controller voltages Cell No for 8 cells >= 9,480 V • Or • Cell voltage Cell No > 4.90 V • Or • Cell voltage Cell No < 1.0 V • Or • Block voltage controller No > 49.0 V • Or • Block voltage controller No < 10.0 V • Or • Cell voltage Cell No – 1.85 V > 0.8 V • Cell No : cell number 0 – 59	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.90 s • Immediately	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0DC0 Hybrid/EV Battery Cell Balancing Circuit "F"	Hybrid/EV Battery Cell Balancing Circuit "F"	• Vol_block Controller No - Σ cell controller voltages Cell No for 7 cells >= 8,295 V • Vol_block Controller No - Σ cell controller voltages Cell No for 8 cells >= 9,480 V • Or • Cell voltage Cell No > 4.90 V • Or • Cell voltage Cell No < 1.0 V • Or • Block voltage controller No > 49.0 V • Or • Block voltage controller No < 10.0 V • Or • Cell voltage Cell No – 1.85 V > 0.8 V • Cell No : cell number 0 – 59	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.80 s • Immediately	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0DC4 Hybrid/EV Battery Cell Balancing Circuit "G"	Hybrid/EV Battery Cell Balancing Circuit "G"	• Vol_block Controller No - Σ cell controller voltages Cell No for 7 cells >= 8,295 V • Vol_block Controller No - Σ cell controller voltages Cell No for 8 cells >= 9,480 V • Or • Cell voltage Cell No > 4.90 V • Or • Cell voltage Cell No < 1.0 V • Or • Block voltage controller No > 49.0 V • Or • Block voltage controller No < 10.0 V • Or • Cell voltage Cell No – 1.85 V > 0.8 V • Cell No : cell number 0 – 59	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.80 s • Immediately	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0DC8 Hybrid/EV Battery Cell Balancing Circuit "H"	Hybrid/EV Battery Cell Balancing Circuit "H"	• Vol_block Controller No - Σ cell controller voltages Cell No for 7 cells >= 8,295 V • Vol_block Controller No - Σ cell controller voltages Cell No for 8 cells >= 9,480 V • Or • Cell voltage Cell No > 4.9 V • Or • Cell voltage Cell No < 1.0 V • Or • Block voltage controller No > 49.0 V • Or • Block voltage controller No < 10.0 V • Or • Cell voltage Cell No – 1.85 V > 0.8 V • Cell No : cell number 0 – 59	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.80 s • Immediately	• 1 DCY
U0001 High Speed CAN Communication Bus	High Speed CAN Communication Bus	• CAN controller bus off flag bus off	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• Immediately	• 1 DCY
U0002 High Speed CAN Communication Bus Performance	High Speed CAN Communication Bus Performance	• Any not received	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.45 s	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
U0028	Vehicle Communication Bus A	• CAN controller bus off flag bus off	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• Immediately	• 1 DCY
U0029 Vehicle Communication Bus A	Vehicle Communication Bus A Performance	• Any not received	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.45 s	• 1 DCY
U0100 Lost Communication With ECM/PCM "A"	Lost Communication With ECM/PCM "A"	• Message of CAN not received	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.50 s • Or • 1.0 s • Or • 5.0 s • 0.80 s • 0.50 s • 5.0 s	• 2 DCY
U0110 Lost Communication With Drive Motor Control Module "A"	Lost Communication With Drive Motor Control Module "A"	• Message of CAN not received	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.50 s • Or • 1.0 s • Or • 5.0 s • 0.80 s • 0.50 s • 5.0 s	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
U0121 Lost Communication With Anti-Lock Brake System (ABS) Control Module	Lost Communication With Anti-Lock Brake System (ABS) Control Module	• Message of CAN not received	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.50 s • Or • 1.0 s • Or • 5.0 s • 0.80 s • 0.50 s • 5.0 s	• 2 DCY
U0146 Lost Communication With Gateway "A"	Lost Communication With Gateway "A"	• Message of CAN not received	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 0.50 s • Or • 1.0 s • Or • 5.0 s • 0.80 s • 0.50 s • 5.0 s	• 2 DCY
U0401 Invalid Data Received From ECM/PCM "A"	Invalid Data Received From ECM/PCM "A"	• DLC of received message shorter than specification • Or • Consecutive messages with same message counter >= 5 • Or • Checksum invalid • DLC of received message shorter than specification	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1 time • Or • Message cycle	• 2 DCY • Or • 1 DCY
U0411 Invalid Data Received From Drive Motor Control Module "A"	Invalid Data Received From Drive Motor Control Module "A"	• DLC of received message shorter than specification • Or • Consecutive messages with same message counter >= 5 • Or • Checksum invalid • DLC of received message shorter than specification	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1 time • Or • Message cycle	• 2 DCY • Or • 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
U0415 Invalid Data Received From Anti-Lock Brake System (ABS) Control Module	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module	• DLC of received message shorter than specification • Or • Consecutive messages with same message counter >= 5 • Or • Checksum invalid • DLC of received message shorter than specification	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 3 times	• 2 DCY
U0447 Invalid Data Received From Gateway "A"	Invalid Data Received From Gateway "A"	• DLC of received message shorter than specification • Or • Consecutive messages with same message counter >= 5 • Or • Checksum invalid • DLC of received message shorter than specification	• Battery state HV_OFF • Or • PRECHARGE • Or • HV_ON • Or • EMERGENCY_OFF	• 1 time	• 2 DCY

3.6 Electrical Drive DTC Table

3.6.1 Electrical Drive Control Module, 2013-2014 MYs

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0604 Internal Control Module Random Access Memory (RAM) Error	Internal Control Module Random Access Memory (RAM) Error	• CAN-transceiver RAM failure	• System state init		• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P064F Unauthorized Software/Calibration Detected	Unauthorized Software/Calibration Detected	• Internal eeprom value is not plausible false	• System state init	• Once / DCY	• 1 DCY
P06B0 Sensor Power Supply "A" Circuit/Open	Sensor Power Supply "A" Circuit/Open	• VDD5 supply voltage too high internal hardware check			• 1 DCY
P06B1 Sensor Power Supply "A" Circuit Low	Sensor Power Supply "A" Circuit Low	• Supply voltage gate driver too low internal hardware check internal under voltage		• 50 ms. • Continuous	• 1 DCY
P06B2 Sensor Power Supply "A" Circuit High	Sensor Power Supply "A" Circuit High	• Supply voltage gate driver too high internal hardware check internal over voltage		• 50 ms • Continuous	• 1 DCY
P06B4 Sensor Power Supply "B" Circuit Low	Sensor Power Supply "B" Circuit Low	• Power supply voltage too low internal under voltage		• 50 ms • Continuous	• 1 DCY
P06B5 Sensor Power Supply "B" Circuit High	Sensor Power Supply "B" Circuit High	• Power supply voltage too high internal over voltage		• 50 ms • Continuous	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0A1B Drive Motor "A" Control Module Performance	Drive Motor "A" Control Module	• EEPROM erase failure			• 1 DCY
		• EEPROM read failure			
		• EEPROM write failure			
		• Power supply voltages out of range internal failure detection		• 800 ms • Continuous	
		• Internal hardware check internal failure detection			
		• ECU internal hardware check internal failure detection			
		• Internal hardware check	• System state: drive		
P0A2B Drive Motor "A" Temperature Sensor Circuit Range/ Performance	Drive Motor "A" Temperature Sensor Circuit Range/ Performance	• Stator temperature - average rating from IGBT-Phase temperatures > 17° – 34° C	• Engine off time > 6 hr. • System state drive	• 2,500 ms • Once / DCY	• 2 DCY
P0A2C Drive Motor "A" Temperature Sensor Circuit Low	Drive Motor Stator Temperature Sensor Out Of Range High	• Stator temperature too high > + 221° C • Or • Short circuit to ground		• 1,000 ms • Continuously	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0A2D Drive Motor "A" Temperature Sensor Circuit High	Drive Motor "A" Temperature Sensor Circuit High	• Stator temperature too low < -50° C • Or • Short circuit to LV-battery		• 1,000 ms • Continuously	• 2 DCY
P0A40 Drive Motor "A" Position Sensor Circuit Range/Performance	Drive Motor "A" Position Sensor Circuit Range/Performance	• el. Angle of sinus signal - el. Angle of cosinus signal ≠ 82° – 98°	• Drive motor speed > 200 1/min	• 100 ms • Continuously	• 1 DCY
		• Amplitude sinus signal / amplitude cosine signal > 1.22 < 0.82 [-]	• Revolution counter > 3		
		• Calculated drive motor speed with sinus and cosinus signals > 8,502 1/min		• 0 ms • Continuously	
		• Normalize root of sum from sinus square and cosine square signals > 0.875 < 0.025 [-]		• 100 ms • Continuously	
P0A90 Drive Motor "A" Performance	Drive Motor "A" Performance	• Loss of drive motor efficiency ≥ 30%	• Electrical power > ± 15,000 W • Drive motor speed > 1,500 1/min ; < 4,125 1/min	• 2,000 ms • Continuously	• 1 DCY
P0AEE Drive Motor Inverter Temperature Sensor "A" Circuit Range/Performance	Drive Motor Inverter Temperature Sensor "A" Circuit Range/Performance	• Phase U IGBT temperature too low > 5.0 K • And • Phase U IGBT temperature - Phase W IGBT temperature > 5.0 K	• System state drive • RMS Phase current < 10.0 A • And • Diagnostic time > 15.0 s	• 1,000 ms • Continuously	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• Phase U IGBT temperature gradient - Phase V IGBT temperature gradient > 4° C/sec • And • Phase U IGBT temperature gradient - Phase W IGBT temperature gradient | > 4° C/sec	• Drive motor speed > 600 1/min • RMS Phase current > 10.0 A • And • RMS Phase current < 240.0 A • RMS Phase current gradient > 500 A/ms	• 300 ms • Multiple	
P0AEF Drive Motor Inverter Temperature Sensor "A" Circuit Low	Drive Motor Inverter Temperature Sensor "A" Circuit Low	• Phase U IGBT temperature too low < -57° C		• 800 ms • Continuously	• 2 DCY
P0AF0 Drive Motor Inverter Temperature Sensor "A" Circuit High	Drive Motor Inverter Temperature Sensor "A" Circuit High	• Phase U IGBT temperature too high > 161° C		• 800 ms • Continuously	• 2 DCY
P0AF3 Drive Motor Inverter Temperature Sensor "B" Circuit Range/Performance	Drive Motor Inverter Temperature Sensor "B" Circuit Range/Performance	• Phase V IGBT temperature - Phase U IGBT temperature > 5 K • And • Phase V IGBT temperature - Phase W IGBT temperature > 5K	• System state drive • RMS Phase current < 10.0 A • And • Diagnostic time > 15.0 s	• 1,000 ms • Continuously	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0AF4 Drive Motor Inverter Temperature Sensor "B" Circuit Low	Drive Motor Inverter Temperature Sensor "B" Circuit Low	• Phase V IGBT temperature too low < -57° C		• 800 ms • Continuously	• 2 DCY
P0AF5 Drive Motor Inverter Temperature Sensor "B" Circuit High	Drive Motor Inverter Temperature Sensor "B" Circuit High	• Phase V IGBT temperature too high > 161° C		• 800 ms • Continuously	• 2 DCY
P0B15 Hybrid/EV Battery Pack Voltage Sense "B" Circuit Range/Performance	Hybrid/EV Battery Pack Voltage Sense "B" Circuit Range/Performance	• State 1: all contactors off inconsistency • State 2: control negative contactor to close inconsistency • State 3: control precharge contactor to close inconsistency • State 4: control positive contactor to close inconsistency • State 5: control precharge contactor to open in case of malfunction of state 1 to 5 to pin-point: inconsistency • State 6: control negative contactor to open inconsistency	• Battery state precharge	• 2 to 5 s	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0BD2 Drive Motor Inverter Temperature Sensor "C" Circuit Range/Performance	Drive Motor Inverter Temperature Sensor "C" Circuit Range/Performance	• Phase W IGBT temperature - Phase U IGBT temperature > 5.0 K • And • Phase W IGBT temperature - Phase V IGBT temperature > 5.0 K	• System state drive • RMS Phase current < 10.0 A • And • Diagnostic time > 15.0 s	• 1,000 ms. • Continuously	• 2 DCY
		• Phase W IGBT temperature gradient - Phase U IGBT temperature gradient > 4° C/sec • And • Phase W IGBT temperature gradient - Phase V IGBT temperature gradient > 4° C/sec	• Drive motor speed > 600 1/min • RMS Phase current > 10.0 A • And • RMS Phase current < 240.0 A • RMS Phase current gradient > 500 A/ms	• 300 ms • Multiple	
P0BD3 Drive Motor Inverter Temperature Sensor "C" Circuit Low	Drive Motor Inverter Temperature Sensor "C" Circuit Low	• Phase W IGBT temperature too low < -57° C		• 800 ms • Continuously	• 2 DCY
P0BD4 Drive Motor Inverter Temperature Sensor "C" Circuit High	Drive Motor Inverter Temperature Sensor "C" Circuit High	• Phase W IGBT temperature too high > 161° C		• 800 ms • Continuously	• 2 DCY
P0BE6 Drive Motor "A" Phase U	Drive Motor "A" Phase U Current Sensor Circuit Range/Performance	• Phase U current offset > 23.0 A	• System state: Init	• 2,000 ms • Once / DCY	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
Current Sensor Circuit Range/ Performance		• Phase U average current offset > 40.0 A	• System state: Drive • Drive motor speed > 600 1/min ; < 4,125 1/min	• 2,000 ms • Continuously	
		• Phase U current amplitude - Phase V current amplitude > 30.0 A • And • Phase U current amplitude - Phase W current amplitude > 30.0 A			
P0BE7 Drive Motor "A" Phase U Current Sensor Circuit Low	Drive Motor "A" Phase U Current Sensor Circuit Low	• Phase U current negative value too high < -928 A		• 800 ms • Continuously	• 1 DCY
P0BE8 Drive Motor "A" Phase U Current Sensor Circuit High	Drive Motor "A" Phase U Current Sensor Circuit High	• Phase U current positive value too high > 921.0 A		• 800 ms • Continuously	• 1 DCY
P0BEA Drive Motor "A" Phase V Current Sensor Circuit Range/ Performance	Drive Motor "A" Phase V Current Sensor Circuit Range/Performance	• Phase V current offset > 23.0 A	• System state: Init	• 2,000 ms • Once / DCY	• 1 DCY
		• Phase V average current offset > 40.0 A	• System state: Drive • Drive motor speed > 600 1/min ; < 4,125 1/min	• 2,000 ms • Continuously	

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• Phase V current amplitude - Phase W current amplitude > 30.0 A • And • Phase V current amplitude - Phase U current amplitude > 30.0 A			
P0BEB Drive Motor "A" Phase V Current Sensor Circuit Low	Drive Motor "A" Phase V Current Sensor Circuit Low	• Phase V current negative value too high < -921.0 A		• 800 ms • Continuously	• 1 DCY
P0BEC Drive Motor "A" Phase V Current Sensor Circuit High	Drive Motor "A" Phase V Current Sensor Circuit High	• Phase V current positive value too high > 921.0 A		• 800 ms • Continuously	• 1 DCY
P0BEE Drive Motor "A" Phase W Current Sensor Circuit Range/Performance	Drive Motor "A" Phase W Current Sensor Circuit Range/Performance	• Phase W current offset > 23.0 A		• 2,000 ms • Once / DCY	• 1 DCY
		• Phase W average current offset > 40.0 A	• System state init • Drive motor speed > 600 1/min ; < 4,125 1/min	• 2,000 ms • Continuously	
		• Phase W current amplitude - Phase U current amplitude > 30.0 A • And • Phase W current amplitude - Phase V current amplitude > 30.0 A			

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0BEF Drive Motor "A" Phase W Current Sensor Circuit Low	Drive Motor "A" Phase W Current Sensor Circuit Low	• Phase W current negative value too high < -921.0 A		• 800 ms • Continuously	• 1 DCY
P0BF0 Drive Motor "A" Phase W Current Sensor Circuit High	Drive Motor "A" Phase W Current Sensor Circuit High	• Phase W current positive value too high > 921.0 A		• 800 ms • Continuously	• 1 DCY
P0BFD Drive Motor "A" Phase U-V-W Current Sensor Correlation	Drive Motor "A" Phase U-V-W Current Sensor Correlation	• Phase U + Phase V + Phase W > 40.0 A	• Drive motor speed > 600 1/min ; < 4,125 1/min	• 1,000 ms • Continuously	• 1 DCY
P0BFF Drive Motor "A" Current	Drive Motor "A" Current	• Calculated drive motor voltage - drive motor model voltage > 100 V • Or • Calculated drive motor current - drive motor model current > 30.0 A		• 1,000 ms • Continuously	• 1 DCY
P0C01 Drive Motor "A" Current High	Drive Motor "A" Current High	• Phase U,V,W signal range check > 745.0 A	• System state: drive	• Continuously	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0C17 Drive Motor "A" Position Sensor Not Learned	Drive Motor "A" Position Sensor Not Learned	• Offset angle estimation < -150 1/min • Offset angle deviation > 549,976°	• System state: Offset angle calibration		• 1 DCY
P0C4E Drive Motor "A" Position Exceeded Learning Limit	Drive Motor "A" Position Exceeded Learning Limit	• Incorrect order of signal change of position sensor wrong order [-]	• System state: Offset angle calibration		• 1 DCY
		• Time for acceleration too long > 2.5 sec.			
		• Drive motor speed while acceleration > 2,250 1/min			
		• Phase current > 0.0 A	• System state: offset angle calibration and active freewheeling		
		• Time to calculate offset angle > 0.3 s	• System state: Offset angle calibration		
P0C51 Drive Motor "A" Position Sensor Circuit "A" Range/ Performance	Drive Motor "A" Position Sensor Circuit "A" Range/ Performance	• Position sensor signal > 4,550 V		• 20 ms • Continuously	• 1 DCY
		• Position sensor signal < 0.450 V			
		• Position sensor signal amplitude > 2.05 V ; < 0.75 V	• Revolution counter > 3.0	• 100 ms • Continuously	
		• Position sensor signal mean value > 2.80 V ; < 2.20 V			
P0C52 Drive Motor "A" Position Sensor Circuit "A" Low	Drive Motor "A" Position Sensor Circuit "A" Low	• Position sensor signal < 0.064 V		• 10 ms • Continuously	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0C53 Drive Motor "A" Position Sensor Circuit "A" High	Drive Motor "A" Position Sensor Circuit "A" High	• Position sensor signal > 4,889 V		• 10 ms • Continuously	• 1 DCY
P0C5B Drive Motor "A" Position Sensor Circuit "B" Range/ Performance	Drive Motor "A" Position Sensor Circuit "B" Range/ Performance	• Position sensor signal > 4,550 V		• 20 ms • Continuously	• 1 DCY
		• Position sensor signal < 0.450 V			
		• Position sensor signal amplitude > 2.05 V ; < 0.75 V	• Revolution counter > 3.0	• 100 ms • Continuously	
		• Position sensor signal mean value > 2.80 V ; < 2.20 V			
P0C5C Drive Motor "A" Position Sensor Circuit "B" Low	Drive Motor "A" Position Sensor Circuit "B" Low	• Position sensor signal < 0.064 V		• 10 ms • Continuously	• 1 DCY
P0C5D Drive Motor "A" Position Sensor Circuit "B" High	Drive Motor "A" Position Sensor Circuit "B" High	• Position sensor signal > 4,889 V		• 10 ms • Continuously	• 1 DCY
P0C79 Drive Motor "A" Inverter Voltage Too High	Drive Motor "A" Inverter Voltage Too High	• DC link voltage too high > 420.0 V		• Continuously	• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0D2E Drive Motor "A" Inverter Voltage Sensor “A” Circuit Range/Performance	Drive Motor "A" Inverter Voltage Sensor Circuit Range/Performance	• DC link voltage (BECM) - DC link voltage (DMCM) > 9.0 V – 24.0 V	• DC link voltage (BECM) signal valid • And • BECM-Contactors close	• 1,000 ms • Continuously	• 1 DCY
P0D30 Drive Motor "A" Inverter Voltage Sensor “A” Circuit High	Drive Motor "A" Inverter Voltage Sensor Circuit High	• DC link voltage too high > 440.0 V		• 800 ms • Continuously	• 1 DCY
P151A Control Module Incorrect Code	Control Module Incorrect Code	• Comparison between internal coding value and CAN message coding value false		• Continuously	• 1 DCY
P33CA Power Electronics Control Module Incorrect Software Version	Power Electronics Control Module Incorrect Software Version	• Internal failure detection			• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P33D4 Drive Motor "A" Magnetic Flow Calibration Implausible	Drive Motor "A" Magnetic Flow Calibration Implausible	• Deviation of measured magnetic flux from nominal magnetic flux > 25%	• Offset angle calibration active • And • Difference between inverter temperature model and drive motor stator temperature < 30.0 K • And • Drive motor stator temperature < 60° C		• 1 DCY
P33D7 Control Module For Power Electronic, Output Module 1 Internal Malfunction	Control Module For Power Electronic, Output Module 1 Internal Malfunction	• IGBT module hardware check internal failure detection			• 1 DCY
P33D8 Control Module for Power Eelectronic, Output Module 2 Internal Malfunction	Control Module For Power Electronic, Output Module 2 Internal Malfunction	• IGBT module hardware check internal failure detection			• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P33D9 Control module for power electronic, HV input current Implausible	Control Module For Power Electronic, HV Input Current Implausible	• DC link current (BECM) + (DC link current (DMCM) + 20 A > 50 A	• Drive motor speed > 0 1/min ; < 6,800 1/min	• 600 ms. • Continuously	• 1 DCY
P33DA Control Module For Power Electronic Software Or Hardware Version, Implausible	Control Module For Power Electronic Software Or Hardware Version, Implausible	• Internal failure detection			• 1 DCY
U0001 High Speed CAN Communication Bus	High Speed CAN Communication Bus	• CAN-Bus "power train CAN" failure			• 1 DCY
U0002 High Speed CAN Communication Bus Performance	High Speed CAN Communication Bus Performance	• CAN-Bus "power train CAN" lost communication			• 1 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
U0028 Vehicle Communication Bus A	Vehicle Communication Bus A	• CAN-Bus "hybrid CAN" failure			• 1 DCY
U0029 Vehicle Communication Bus A Performance	Vehicle Communication Bus A Performance	• CAN-Bus "hybrid CAN" lost communication			• 1 DCY
U0100 Lost Communication With ECM/PCM "A"	Lost Communication With ECM/PCM "A"	• CAN message time out			• 1 DCY
U0111 Lost Communication With Battery Energy Control Module "A"	Lost Communication With Battery Energy Control Module "A"	• CAN message time out			• 1 DCY
U0122 Lost Communication With Vehicle Dynamics Control Module	Lost Communication With Vehicle Dynamics Control Module	• CAN message time out		• 500 ms • Continuously	• 2 DCY

DTC	Error Message	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
U0401 Invalid Data Received From ECM/PCM "A"	Invalid Data Received From ECM/PCM "A"	• CAN checksum error signal length information content			• 1 DCY
U0412 Invalid Data Received From Battery Energy Control Module "A"	Invalid Data Received From Battery Energy Control Module "A"	• CAN checksum error signal length information content			• 1 DCY
U0416 Invalid Data Received From Vehicle Dynamics Control Module	Invalid Data Received From Vehicle Dynamics Control Module	• CAN signal length			• 2 DCY

3.7 Transmission DTC Table

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3.7.1 Transmission Mechatronic, DSG 7 speed 0CG (2013-2014 MY)

DQ200-7F 0CG							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0606	Control Module Processor	• Internal voltage check	• Detection of too low or too high sensor voltage supply of both gearbox subsystems	• Lower voltage = 4.5 V • Upper voltage = 5.5 V	• TCU supply voltage > 9.0 V	• 100.0 ms	• 2 DCY • continuous
P0701	Transmission Control System Range/ Performance	• Signal range check	• Detection of incorrect input (AD Value) from sensor	• "Lower AD Value = 100.0 • Upper AD Value = 3,800	• "TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V • Internal sensor supply voltage of gearbox subsystem 1.0 V > 4.5 V • "TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V • Internal sensor supply voltage of gearbox subsystem 2.0 V > 4.5 V	• 300.0 ms	• 2 DCY • continuous
P0715	Input Turbine/ Speed Sensor "A" Circ.	• Electrical check	• Open circuit and short circuit detection	• Open circuit if sensor input voltage < 1.0 V by internal auxiliary voltage > 5.0 V. • Short circuit if sensor input voltage > internal auxiliary voltage - 0.5 V.	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V • Internal sensor supply voltage of gearbox subsystem 2.0 V > 4.5 V	• 300.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P072B	Stuck In Reverse	• Plausibility check	• Mismatch in performance/plausibility of current gear set shifter position to desired position	• Actualpos > 55.0 mm & Calcpos < 45.0 mm For 1.0 s	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous
			• Maximum attempts of engagement is exceeded. Separate error memory for each gear.	• 3x unsuccessful attempts to engage the selected gear.			
P072C	Stuck in Gear 1	• Plausibility check	• Mismatch in Performance/ Plausibility of Current Gear Set Shifter Position to Desired Position	• Actualpos > 55.0 mm & Calcpos < 45.0 mm For 1.0 s	• Common high side switch of gearbox Subsystem 1 is on, and CHS output voltage > 9.0 V • TCU Supply Voltage < 16.0 V Or • Common high side switch of gearbox subsystem 2iIs on, and CHS output voltage > 9.0 V • TCU Supply Voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous
			• Maximum attempts of engagement is exceeded. Separate error memory for each gear.	• 3x unsuccessful attempts to engage the selected gear.			

DQ200-7F 0CG							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P072D	Stuck in Gear 2	• Plausibility check	• Mismatch in performance/plausibility of current gear set shifter position to desired position	• Actualpos > 55.0 mm & Calcpos < 45.0 mm for 1.0 s	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous
			• Maximum attempts of engagement is exceeded. Separate error memory for each gear.	• 3x unsuccessful attempts to engage the selected gear.			
P072E	Stuck in Gear 3	• Plausibility check	• Mismatch in performance/plausibility of current gear set shifter position to desired position	• Actualpos > 55.0 mm & Calcpos < 45.0 mm for 1.0 s	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous
			• Maximum attempts of engagement is exceeded. Separate error memory for each gear.	• 3x unsuccessful attempts to engage the selected gear.			

DQ200-7F 0CG							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P072F	Stuck in Gear 4	• Plausibility check	• Mismatch in performance/plausibility of current gear set shifter position to desired position	• Actualpos > 55 mm & Calcpos < 45 mm for 1 s	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20 ms	• 2 DCY • continuous
			• Maximum attempts of engagement is exceeded. Separate error memory for each gear.	• 3x unsuccessful attempts to engage the selected gear.			
P073A	Stuck in Gear 5	• Plausibility check	• Mismatch in performance/plausibility of current gear set shifter position to desired position	• Actualpos > 55.0 mm & Calcpos < 45.0 mm for 1.0 s	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > .09 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous
			• Maximum attempts of engagement is exceeded. Separate error memory for each gear.	• 3x unsuccessful attempts to engage the selected gear.			

DQ200-7F 0CG							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P073B	Stuck in Gear 6	• Plausibility check	• Mismatch in performance/plausibility of current gear set shifter position to desired position	• Actualpos > 55.0 mm & Calcpos < 45.0 mm for 1 s	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous
			• Maximum attempts of engagement is exceeded.Separate error memory for each gear.	• 3x unsuccessful attempts to engage the selected gear.			
P073C	Stuck in Gear 7	• Plausibility check	• Mismatch in performance/plausibility of current gear set shifter position to desired position	• Actualpos > 55.0 mm & Calcpos < 45.0 mm for 1.0 s	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous
			• Maximum attempts of engagement is exceeded. Separate error memory for each gear.	• 3x unsuccessful attempts to engage the selected gear.			
P073E	Unable to Engage Reverse	• Plausibility check	• Mismatch in performance/plausibility of current gear set	• Actualpos > 55.0 mm & Calcpos < 45.0 mm for 1.0 s	• Common high side switch of gearbox subsystem 1 is on, and	• 20.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			shifter position to desired position		CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
		• Performance check	• "Synchronization unsuccessful. Separate error memory for each gear."	• [Integral(delta_n/n_norm*P_Tgr/15bar)-50] > 150	OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P073F	Unable to Engage Gear 1	• Performance check	• "Synchronization unsuccessful. Separate error memory for each gear."	• [Integral(delta_n/n_norm*P_Tgr/15bar)-50] > 150	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous
P0746	Pressure Control Solenoid "A" Performance/ Stuck Off	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
			• Open load detection	• Measured current < required current + 200.0 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0747	Pressure Control Solenoid "A" Stuck On	• Electrical check	• Short circuit detection	• Measured current > required current + 200.0 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
			• Open load detection	• Measured current < required current + 200.0 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		

DQ200-7F 0CG							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P074A	Unable To Engage Gear 2	• Performance check	• "Synchronization unsuccessful. Separate error memory for each gear."	• [Integral(delta_n/n_norm*P_Tgr/15bar)-50] > 150	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 2.00 ms	• 2 DCY • continuous
P074B	Unable To Engage Gear 3	• Performance check	• "Synchronization unsuccessful. Separate error memory for each gear."	• [Integral(delta_n/n_norm*P_Tgr/15bar)-50] > 150	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P074C	Unable To Engage Gear 4	• Performance check	• "Synchronization unsuccessful. Separate error memory for each gear."	• [Integral(delta_n/n_norm*P_Tgr/15bar)-50] > 150	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous
P074D	Unable To Engage Gear 5	• Performance check	• "Synchronization unsuccessful. Separate error memory for each gear."	• [Integral(delta_n/n_norm*P_Tgr/15bar)-50] > 150	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P074E	Unable to Engage Gear 6	• Performance check	• "Synchronization unsuccessful. Separate error memory for each gear."	• [Integral(delta_n/n_norm*P_Tgr/15bar)-50] > 150	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous
P074F	Unable to Engage Gear 7	• Performance check	• "Synchronization unsuccessful. Separate error memory for each gear."	• [Integral(delta_n/n_norm*P_Tgr/15bar)-50] > 150	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0751	Shift Solenoid "A" Performance/ Stuck Off	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
			• Open load detection	• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0752	Shift Solenoid "A" Stuck On	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output	• 240.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
			• Open load detection	• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0756	Shift Solenoid "B" Performance/ Stuck Off	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
			• Open load detection	• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0757	Shift Solenoid "B" Stuck On	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
			• Open load detection	• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0761	Shift Solenoid "C" Performance/ Stuck Off	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
			• Open load detection	• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0762	Shift Solenoid "C" Stuck On	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
			• Open load detection	• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0766	Shift Solenoid "D" Performance/ Stuck Off	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
			• Open load detection	• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0767	Shift Solenoid 'D' Stuck On	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
			• Open load detection	• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0776	Pressure Control Solenoid "B" Performance/ Stuck Off	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
			• Open load detection	• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0777	Pressure Control Solenoid "B" Stuck On	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
			• Open load detection	• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0780	Shift Error	• Performance check	• Mismatch at parallelism of current gear set shifter position to desired position	• Integral ((calc - actual) - 0,5 mm)] > 50 mm [Position]	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0791	Intermediate Shaft Speed Sensor "A" Circuit	• Range check	• Detection of sensor element signal failure (no signal)	• Clutch speed near zero while gear engaged and vehicle driving	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V	• 140.0 ms	• 2 DCY • continuous
P0805	Clutch Position Sensor "A" Circuit	• Signal range check	• Detection of incorrect input (PWM signal) from sensor element	• Lower PWM duty cycle = 7.5% • Upper PWM duty cycle = 92.5%	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 100.0 ms	• 2 DCY • continuous
P0806	Clutch Position Sensor "A" Circuit Range/ Performance	• Matching check	• Detection of incorrect instant sum of both sensor element duty cycles for each clutch	• Lower sum threshold = 95% • Upper sum threshold = 105%	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 100.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P0809	Clutch Position Sensor "A" Circuit Intermittent	• Signal failure check	• Detection of sensor element signal failure (no signal)		• Internal sensor supply voltage of gearbox subsystem 1.0 V > 4.5 V	• 100 ms	• 2 DCY • continuous
					• Internal sensor supply voltage of gearbox subsystem 2.0 V > 4.5 V		
P0810	Clutch Position Control Error	• Plausibilty check	• Mismatch of current clutch position to desired position	• Current position for "clutch open" exceeds limits -3 mm – +3 mm	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 1,000 ms	• 2 DCY • continuous
				• Clutch #1 closes unintended		• 300.0 ms	
				• Clutch #1 opens unintended		• 12 times in 30.0 s	
				• Current position for "clutch open" exceeds limits -3 mm – +3 mm	• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 1,000 ms	
				• Clutch #2 closes unintende		• 300.0 ms	
				• Clutch #2 opens unintended		• 12 times in 30.0 s	

DQ200-7F 0CG							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0820	Control Module Programming Error	• Plausibility check	• Evaluation of message from gear lever	• Failure flag in message is set	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V	• 1,000 ms	• 2 DCY • continuous
P0841	Transmission Fluid Pressure Sensor/ Switch "A" Circuit Range/ Performance	• Plausibility check	• Pressure in main line implausible to actuation	• Pressure < 35.0 bar and hydaulic pump on	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V	• 500.0 ms	• 2 DCY • continuous
				• Pressure < 3.00 bar and hydaulic pump on (HYBRID MODE)		• 60.0 s	
P0864	TCM Communication Circuit Range/ Performance	• Electrical check	• short or open circuit detection	• CAN-Transmit error count > 128	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V	• 3 events	• 2 DCY • continuous
P0868	Transmission Fluid Pressure Low	• Plausibility check	• Adaption upper limit reached	• Pressure < 35.0 bar and hydaulic pump on	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V OR • Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous
			• Adaption lower limit reached	• Pressure < 30.0 bar and hydaulic pump on			
P0914	Gear Shift Position Circuit "A"	• Plausibility check	• Evaluation of message from gear lever	• No plausible position for 1 s	• TCU supply voltage > 9.0 V	• 440.0 ms	• 2 DCY

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
				• No valid Q & A - Result for 1.2 s	• TCU supply voltage < 16.0 V		• continuous
P0919	Gear Shift Position Control Error	• Plausibility check	• State machine of gear lever is checked in TCU	• State #1 error	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V	• 20.0 ms	• 2 DCY • continuous
				• State #2 error		• 1,000.0 ms	
				• State #3 error		• 500.0 ms	
				• State #4 error		• 300.0 ms	
				• State #5 error			
				• State #6 error			
P2723	Pressure Control Solenoid "E" Performance/ Stuck Off	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous
				• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2724	Pressure Control Solenoid "E" Stuck On	• Electrical ccheck	• Short circuit detection	• measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous
				• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P2732	Pressure Control Solenoid "F" Performance/ Stuck Off	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous
				• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		

DQ200-7F 0CG							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P2733	Pressure Control Solenoid "F" Stuck On	• Electrical check	• Short circuit detection	• Measured current > required current + 200 mA.	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 240.0 ms	• 2 DCY • continuous
				• Measured current < required current + 200 mA.	• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V		
P2765	Input/ Turbine Shaft Speed Sensor "B" Circuit	• Electrical check	• Open circuit and short circuit detection	• Open circuit if sensor input voltage < 1.0 V by internal auxiliary voltage > 5.0 V. • Short circuit if sensor input voltage > internal auxiliary voltage - 0.5 V.	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V • Internal sensor supply voltage of Gearbox subsystem 2.0 > 4.5 V	• 300.0 ms	• 2 DCY • continuous
P2789	Clutch "A" Adaptive Learning at Limit	• Result check	• Adaption limits exceeded	• Adaption for clutch #1 reaches upper or lower limit	• Common high side switch of gearbox subsystem 1 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 16.0 V	• 12 times in 300.0 s	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
				• Adaption for clutch #2 reaches upper or lower limit	• Common high side switch of gearbox subsystem 2 is on, and CHS output voltage > 9.0 V • TCU supply voltage < 1.06 V		
P2832	Shift Fork "A" Position Circuit Range/ Performance	• Matching check	• Detection of output mismatch of both sensors of one gear set shifter	• Depending on the output of the first sensor, a lower and an upper value from threshold lines are defined for the second sensor.	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V • Internal sensor supply voltage of Gearbox subsystem 1.0 > 4.5 V • TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V • Internal sensor supply voltage of Gearbox subsystem 2.0 > 4.5 V	• 300.0 ms	• 2 DCY • continuous
P2837	Shift Fork "B" Position Circuit Range/ Performance	• Matching check	• Detection of output mismatch of both sensors of one gear set shifter	• Depending on the output of the first sensor, a lower and an upper value from threshold lines are defined for the second sensor.	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V • Internal sensor supply voltage of Gearbox subsystem 1.0 > 4.5 V	• 300.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V • Internal sensor supply voltage of Gearbox subsystem 2.0 > 4.5 V		
P283C	Shift Fork "C" Position Circuit Range/ Performance	• Matching check	• Detection of output mismatch of both sensors of one gear set shifter	• Depending on the output of the first sensor, a lower and an upper value from threshold lines are defined for the second sensor.	• TCU supply voltage > 9.0 V • TCU supply voltage < 1.06 V • Internal sensor supply voltage of Gearbox subsystem 1.0 V > 4.5 V • TCU supply voltage > 9.0 V • TCU supply voltage < 1.06 V • Internal sensor supply voltage of Gearbox subsystem 2.0 V > 4.5 V	• 300.0 ms	• 2 DCY • continuous
P2841	Shift Fork "D" Position Circuit Range/ Performance	• Matching check	• Detection of output mismatch of both sensors of one gear set shifter	• Depending on the output of the first sensor, a lower and an upper value from threshold lines are defined for the second sensor.	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V • Internal sensor supply voltage of Gearbox subsystem 1.0 > 4.5 V	• 300.0 ms	• 2 DCY • continuous

DQ200-7F 0CG							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
					• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V • Internal sensor supply voltage of Gearbox subsystem 2.0 > 4.5 V		
U0002	High Speed CAN Communication Bus Performance	• Timeout check	• Received messages missing	• No message received	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V	• 470.0 ms	• 2 DCY • continuous
U0100	Lost Communication With ECM/PCM "A"	• Timeout Check	• Received messages missing	• No messages from MSG received	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V	• 460.0 ms	• 2 DCY • continuous
U0103	Lost Communication With Gear Shift Control Module "A"	• Timeout check	• No communication	• No message from gear lever received	• TCU supply voltage > 9.0 V • TCU supply voltage < 16.0 V	• 440.0 ms	• 2 DCY • continuous

3.8 Diagnostic Procedures

- ⇒ A3.8.1 ccelerator Pedal Module GX2, Checking”, page 214
- ⇒ B3.8.2 rake Booster Pressure Sensor G294, Checking”, page 216
- ⇒ B3.8.3 rake Booster RelayJ569 / Brake Booster Vacuum Pump V192, Checking”, page 218
- ⇒ C3.8.4 amshaft Adjustment Valve 1 N205, Checking ”, page 221
- ⇒ C3.8.5 amshaft Position Sensor G40 , Checking ”, page 223
- ⇒ C3.8.6 amshaft Position Sensor 3 G300, Checking”, page 225
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- ⇒ T3.8.8 erminal Resistance, Powertrain, Checking", page 229
- ⇒ C3.8.9 harge Air Pressure Sensor GX26, Checking", page 231
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- ⇒ E3.8.11 ngine Coolant Temperature SensorG62, Checking", page 235
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- ⇒ F3.8.17 uel Delivery UnitGX1 / Fuel Pump Control Module J538, Testing", page 246
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- ⇒ I3.8.25 ntake Manifold SensorGX9, Checking", page 261
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- ⇒ P3.8.34 ositive Crankcase Ventilation Heating ElementN79, Checking", page 281

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- ⇒ S3.8.36 econdary Air SystemGX24, Checking", page 285
- ⇒ W3.8.37 ay Catalytic Converter (TWC), Checking", page 288
- ⇒ T3.8.38 hrottle Valve Control Module GX3, Checking", page 289
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3.8.1 Accelerator Pedal Module - GX2-, Checking

General Description

The Accelerator Pedal Position Sensor -G79- and Accelerator Pedal Position Sensor 2 -G185- are combined in one component and integrated into the Accelerator Pedal Module - GX2-. They are used to detect the position of the accelerator pedal throughout the entire adjustment range. The Engine Control Module - J623- detects the driver's request from these signals and uses them to calculate the injection quantity and EPC Throttle valve operation.

The Accelerator Pedal Module - GX2- contains the following components:

- Accelerator Pedal Position Sensor -G79-
- Accelerator Pedal Position Sensor 2 -G185-

The Accelerator Pedal Module - GX2- components cannot be serviced separately, and must be serviced as a unit.

Special tools and workshop equipment required

- Multimeter.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Manual Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ", page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 215 . – NO: ♦ GATHER more information from customer about the complaint.

Step	Procedure	Result / Action to Take
2	• CONNECT: Scan Tool. • IGNITION: ON. • CHECK: Throttle valve position closed: • SPECIFIED VALUE: 3 – 25%. • DEPRESS: Accelerator pedal slowly to WOT while observing the percentage display. The percentage display must increase uniformly. • CHECK: Throttle valve position at WOT: • SPECIFIED VALUE: 84 – 99%. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ Condition may be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 216 . – NO: ◆ GO TO: Step 3 ⇒ page 215 .
3	• DISCONNECT: Accelerator Pedal Module - GX2- harness connector. • IGNITION: ON. • CHECK: Accelerator Pedal Module - GX2- harness connector terminals 1 to 5 and 2 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Were Values obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 215 . – NO: ◆ GO TO: Step 5 ⇒ page 216 .
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 4 to the Engine Control Module - J623- harness connector T94 / 79 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 6 to the Engine Control Module - J623- harness connector T94 / 57 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Accelerator Pedal Module - GX2-. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 216 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 216 .

Step	Procedure	Result / Action to Take
5	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 58 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 80 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 78 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 5 to the Engine Control Module - J623- harness connector T94 / 56 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 6 ⇒ page 216 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 216 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return, the repair is complete. ◆ Return vehicle to customer.

3.8.2 Brake Booster Pressure Sensor - G294-, Checking

General Description

The Brake Booster Pressure Sensor -G294- is installed in the line running to the brake servo unit. When the ignition is switched on, the pressure sensor is supplied with a voltage of 5 V. Inside the pressure sensor, there is a diaphragm with strain gauges. If the pressure within the sensor changes, the electrical resistance of the strain gauges also changes. This produces a voltage signal by means of an amplifier in the pressure sensor.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 217 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Brake Booster Pressure Sensor -G294- harness connector. • IGNITION: ON. • CHECK: Brake Booster Pressure Sensor -G294- harness connector terminals 1 to 3 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: About 5.0 V. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 217 . – NO: ◆ GO TO: Step 4 ⇒ page 218 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Brake Booster Pressure Sensor -G294- harness connector terminal 4 to the Engine Control Module - J623- harness connector T94 / 20 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Brake Booster Pressure Sensor -G294-. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 218 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 218 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Brake Booster Pressure Sensor - G294- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 14 for resistance. • CHECK: Brake Booster Pressure Sensor - G294- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 19 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 218 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 218 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.8.3 Brake Booster Relay -J569- / Brake Booster Vacuum Pump - V192-, Checking

General Description

The Brake Booster Relay -J569- and the Brake System Vacuum Pump -V192- are used to provide vacuum to the brake booster during times of the engine not running due to the e-machine maintaining forward motion of the vehicle. During this time, the engine will not provide any vacuum to the brake booster, so the Brake Booster Relay -J569- is closed by the Engine Control Module -J623-, providing power to the Brake System Vacuum Pump -V192-, which in turn provides vacuum to the brake booster to allow proper brake operation.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 219 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Brake Booster Relay -J569-. • IGNITION: ON. • CHECK: Brake Booster Relay -J569- harness connector terminals 2 and 4 to ground for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Were Values obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 219 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 221 .
3	• CONNECT: Jumper wire, Brake Booster Relay -J569- harness connector terminals 2 and 8. • IGNITION: ON. • SPECIFIED VALUE: The Brake System Vacuum Pump -V192- should be heard running. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 220 . – NO: ◆ GO TO: Step 5 ⇒ page 220 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Jumper wire from Brake Booster Relay -J569- harness connector terminals 2 and 8. • REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Brake Booster Relay -J569- harness connector terminal 6 to the Engine Control Module -J623- harness connector T94 / 93 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ REPLACE: Brake Booster Relay -J569-. Refer to appropriate repair manual. ♦ GO TO: Step 7 ⇒ page 221 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 7 ⇒ page 221 .
5	• REMOVE: Jumper wire, Brake Booster Relay -J569- harness connector terminals 30 and 87. • DISCONNECT: Brake System Vacuum Pump -V192-. • CHECK: Brake System Vacuum Pump -V192- harness connector terminal 1 to Brake Booster Relay -J569- terminal 8 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ GO TO: Step 6 ⇒ page 220 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 7 ⇒ page 221 .
6	• CHECK: Brake System Vacuum Pump -V192- harness connector terminal 2 to ground for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ REPLACE: Brake System Vacuum Pump -V192-. Refer to appropriate repair manual. ♦ GO TO: Step 7 ⇒ page 221 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 7 ⇒ page 221 .

Step	Procedure	Result / Action to Take
7	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.4 Camshaft Adjustment Valve 1 - N205-, Checking

General Description

The camshaft's task is to operate the valves at the right time and in the right order to control the charge cycle. Camshaft adjustment using the Camshaft Adjustment Valve 1 -N205- varies the opening times of the valves to suit all operating conditions. This ensures ideal charge cycles within a wide range of engine speeds and loads. Fuel consumption and pollutant emissions are reduced, torque and smoothness increased. In engines with a double overhead camshaft the size and positioning of the valve opening overlap can be influenced, enhancing characteristics in full-load and part-load operation. In continuous camshaft adjustment, the adjustment is infinitely variable within specific parameters.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Manual Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .

- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ", page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 222 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Camshaft Adjustment Valve 1 -N205- harness connector. • CHECK: Camshaft Adjustment Valve 1 - N205- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 5 – 20 Ω (+/- 3 Ω @ approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 222 . – NO: ♦ REPLACE: Camshaft Adjustment Valve 1 - N205-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 223 .
3	• IGNITION: ON. • CHECK: Camshaft Adjustment Valve 1 - N205- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 222 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 223 .
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Camshaft Adjustment Valve 1 - N205- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 20 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ TIP: The Camshaft Adjustment Valve 1 - N205- may fail under loaded operation; please swap a known good Camshaft Adjustment Valve 1 -N205- prior to continuing to the next step. ♦ GO TO: Step 5 ⇒ page 223 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 223 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.5 Camshaft Position Sensor - G40 -, Checking

General Description

Using the signal from the Camshaft Position Sensor -G40-, the precise position of the camshaft relative to the crankshaft is determined very quickly when the engine is started. Used in combination with the signal from the Engine Speed Sensor -G28-, the signal from the Camshaft Position Sensor -G40- allows the Engine Control Module -J623- to detect which cylinder is at TDC. The fuel can be injected into the corresponding cylinder and ignited.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ", page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 224 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Camshaft Position Sensor -G40- harness connector. • IGNITION: ON. • CHECK: Camshaft Position Sensor -G40- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 224 . – NO: ◆ GO TO: Step 4 ⇒ page 224 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor -G40- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 44 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Camshaft Position Sensor -G40-. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 225 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 225 .
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor -G40- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 37 for resistance. • CHECK: Camshaft Position Sensor -G40- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 52 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 225 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 225 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.6 Camshaft Position Sensor 3 - G300-, Checking

General Description

Camshaft position sensors are located at each camshaft for control and monitoring of the camshaft adjusters. For exact determination of the camshaft adjustment, the basic settings (retard position) of the camshafts are learned by the control modules (adaptation). During adaptation, the Camshaft solenoid valves are de-energized. The camshafts are moved to the retard position (basic setting) both by the setting of the solenoid valves and the direction of pull exerted by the chain. The position of the camshaft position sensor signals relative to the engine speed sensor reference mark (actual values), is stored as basic position and compared to the specified values.

This provides the basic values for camshaft timing control. A distinction is made between basic and fine adaptation. Basic adaptation is always implemented after the ECM is de-energized (no Terminal 30) or erasing of DTCs. After starting the engine, the camshafts briefly remains in the basic position until the exact position of the camshafts with respect to the crankshaft has been established. If the camshafts are already in basic position (valves de-energized) and the coolant temperature is greater than 185° F (85° C), and assuming basic adaptation has been implemented, fine adaptation is always performed briefly several times (for approximately one second) after starting the engine. Adaptation of the inlet camshafts takes place at idle or in the near idle range. Adaptation of the exhaust camshafts takes place in the engine speed range between 1,200 and 2,000 RPM and at low engine load. The camshaft timing control function is disabled if adaptation is not performed successfully.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 226 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Camshaft Position Sensor 3 -G300- harness connector. • IGNITION: ON. • CHECK: Camshaft Position Sensor 3 -G300- harness connector terminals 1 to 3 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: About 5.0 V. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 226 . – NO: ◆ GO TO: Step 4 ⇒ page 227 .
3	• REMOVE: Engine/Motor Control Module - J623-. Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor 3 -G300- harness connector terminal 2 to the Engine/Motor Control Module - J623- harness connector T60 / 59 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Camshaft Position Sensor 3 - G300-. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 227 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 227 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine/Motor Control Module -J623-. Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor 3 -G300- harness connector terminal 1 to the Engine/Motor Control Module - J623- harness connector T60 / 50 for resistance. • CHECK: Camshaft Position Sensor 3 -G300- harness connector terminal 3 to the Engine/Motor Control Module - J623- harness connector T60 / 52 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 227 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 227 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine/Motor Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine/Motor Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return, the repair is complete. ◆ Return vehicle to customer.

3.8.7 CAN Bus Terminal Resistance, Checking

General Description

The Engine Control Module -J623- communicates with other CAN-Bus capable control modules.

The control modules are connected by two data bus wires which are twisted together (CAN_High and CAN_Low), and exchange information (messages). Missing information on the CAN-bus is recognized as a malfunction by the Engine Control Module -J623- and the other control modules connected to the CAN-bus.

Trouble-free operation of the CAN-Bus requires that it have a terminal resistance. This central terminal resistance is located in the Engine Control Module -J623-.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 228 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Data Bus On Board Diagnostic Interface -J533- harness connector. • The Engine Control Module -J623- must remain connected for the following step. • CHECK: Data Bus On Board Diagnostic Interface -J533- harness connector terminals 6 to 16 for resistance. • Specified value: 60 – 72 Ω (at approx. 20° C). – Was Value obtained?	– YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 229 . – NO: ♦ GO TO: Step 3 ⇒ page 228 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Data Bus On Board Diagnostic Interface -J533- harness connector terminal 6 to the Engine Control Module - J623- harness connector T94 / 67 for resistance. • CHECK: Data Bus On Board Diagnostic Interface -J533- harness connector terminal 16 to the Engine Control Module - J623- harness connector T94 / 68 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 229 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 229 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Data Bus On Board Diagnostic Interface -J533- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Data Bus On Board Diagnostic Interface -J533-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.8 CAN-Bus Terminal Resistance, Powertrain, Checking

General Description

The Engine Control Module -J623- communicates with all databus capable control modules via a CAN databus.

These databus capable control modules are connected via two data bus wires which are twisted together (CAN_High and CAN_Low), and exchange information (messages). Missing information on the databus is recognized as a malfunction and stored.

Trouble-free operation of the CAN-bus requires that it have a terminal resistance. The central terminal resistor is located in the Engine Control Module -J623-.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .

- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ", page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 230 . – NO: ◆ GATHER more information from customer about the complaint.
2	• The Engine Control Module -J623- must remain connected for the following step. The central terminal resistor is located in the Engine Control Module -J623-. • REMOVE: Dual-Clutch Transmission Mechatronic -J743-. Refer to appropriate repair manual. • CHECK: Dual-Clutch Transmission Mechatronic -J743- harness connector terminal 12 to 13 for resistance. • SPECIFIED VALUE: 60 – 72 Ω (at approx. 20° C). – Was Value obtained?	– YES: ◆ CONDITION: May be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 231 . – NO: ◆ GO TO: Step 3 ⇒ page 230
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: CAN bus circuit between the Dual-Clutch Transmission Mechatronic - J743- harness connector terminal 12 and the Engine Control Module -J623- harness connector T94 / 67 for resistance. • CHECK: CAN bus circuit between the Dual-Clutch Transmission Mechatronic - J743- harness connector terminal 13 and the Engine Control Module -J623- harness connector T94 / 68 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 231 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 231 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Dual-Clutch Transmission Mechatronic -J743- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Dual-Clutch Transmission Mechatronic -J743-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.9 Charge Air Pressure Sensor - GX26-, Checking

General Description

The Charge Air Pressure Sensor - GX26- is located in the inlet to the intake manifold. The Engine Control Module -J623- uses the sensor's signal to regulate the charge air pressure. There is no substitute function in the event of signal failure. Charge air pressure regulation is shut off, leading to a significant reduction in engine output.

The Charge Air Pressure Sensor - GX26- contains the following components:

♦ Charge Air Pressure Sensor -G31-

♦ Intake Air Temperature Sensor -G42-

The Charge Air Pressure Sensor - GX26- components cannot be serviced separately, and they must be serviced as a unit.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".

- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 232 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Charge Air Pressure Sensor - GX26- harness connector. • IGNITION: ON. • CHECK: Charge Air Pressure Sensor - GX26- harness connector terminals 3 to 1 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: About 5.0 V. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 232 . – NO: ◆ GO TO: Step 4 ⇒ page 232 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Charge Air Pressure Sensor - GX26- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 13 for resistance. • CHECK: Charge Air Pressure Sensor - GX26- harness connector terminal 4 to the Engine Control Module - J623- harness connector T94 / 34 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Charge Air Pressure Sensor - GX26-. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 233 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 233 .
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Charge Air Pressure Sensor - GX26- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 63 for resistance. • CHECK: Charge Air Pressure Sensor - GX26- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 14 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 233 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 233 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.8.10 Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-, Checking

General Description

The Engine Control Module -J623- computes the nominal charge pressure from the requested torque. If the actual charge pressure deviates from the nominal charge pressure, the wastegate is opened further by the Charge Air Pressure Actuator -V465- (charge pressure decreases) or closed further (charge pressure increases). The rapid response of the Charge Air Pressure Actuator -V465- ensures that the wastegate opens quickly in overrun mode, thereby reducing the pumping effort of the turbocharger. The wastegate is closed in the start position. The Charge Air Pressure Actuator -V465- is activated by the PWM signal, and the Charge Air Pressure Actuator Position Sensor -G581- provides position feedback.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .

- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ", page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 234 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector. • IGNITION: ON. • CHECK: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector terminals 1 to 3 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: About 5.0 V. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 234 . – NO: ♦ GO TO: Step 4 ⇒ page 235 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector terminal 5 to the Engine Control Module - J623- harness connector T60 / 38 for resistance. • CHECK: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 49 for resistance. • CHECK: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector terminal 6 to the Engine Control Module - J623- harness connector T60 / 35 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 235 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 235 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Charge Air Pressure Actuator - V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 26 for resistance. • CHECK: Charge Air Pressure Actuator - V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 14 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω) – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 235 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 235 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return, the repair is complete. ◆ Return vehicle to customer.

3.8.11 Engine Coolant Temperature Sensor - G62-, Checking

General Description

The Engine Coolant Temperature Sensor -G62- sends information about the current coolant temperature to the Engine Control Module -J623-. It uses the coolant temperature as a correction value for calculating the injection quantity.

Special tools and workshop equipment required

◆ Multimeter.

◆ Wiring Diagram.

◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.

- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Gear Shift Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 236 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Engine Coolant Temperature Sensor -G62- harness connector. • CHECK: Engine Coolant Temperature Sensor -G62- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 2,250 Ω (+/- 750 @ approx. 20° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 236 . – NO: ◆ REPLACE: Engine Coolant Temperature Sensor -G62-. Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 237 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Engine Coolant Temperature Sensor -G62- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 10 for resistance. • CHECK: Engine Coolant Temperature Sensor -G62- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 14 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ TIP: The Engine Coolant Temperature Sensor -G62- may fail under loaded operation; please swap a known good Engine Coolant Temperature Sensor -G62- prior to continuing to the next step. ◆ GO TO: Step 4 ⇒ page 237 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 237 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.12 Engine Coolant Temperature Sensor On Radiator Outlet -G83-, Checking

General Description

The Engine Coolant Temperature Sensor On Radiator Outlet -G83- sends information about the current coolant temperature to the Engine Control Module -J623-. It uses the coolant temperature as a correction value for calculating the injection quantity.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Manual Transmission, ensure Gear Shift Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ", page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 238 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Engine Coolant Temperature Sensor On Radiator Outlet -G83- harness connector. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet -G83- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 2,250 Ω (+/- 750 @ approx. 20° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 238 . – NO: ◆ REPLACE: Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 238 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet -G83- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 14 for resistance. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet -G83- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 12 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ TIP: The Engine Coolant Temperature Sensor On Radiator Outlet -G83- may fail under loaded operation; please swap a known good Engine Coolant Temperature Sensor On Radiator Outlet -G83- prior to continuing to the next step. ◆ GO TO: Step 4 ⇒ page 238 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 238 .
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.13 Engine Speed Sensor - G28-, Checking

General Description

The Engine Speed Sensor -G28- detects rpm and reference marks from a toothed wheel on the crankshaft. Without an engine speed signal, the engine will not start. If the engine speed signal fails while the engine is running, the engine will stop immediately.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Gear Shift Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 239 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • CONNECT: Scan Tool. • START or CRANK: Engine. • CHECK: Engine RPM. • SPECIFIED VALUE: Cranking or Idle RPM. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 240 . – NO: ♦ GO TO: Step 3 ⇒ page 240 .

Step	Procedure	Result / Action to Take
3	• DISCONNECT: Engine Speed Sensor -G28- harness connector. • REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Engine Speed Sensor -G28- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 50 for resistance. • CHECK: Engine Speed Sensor -G28- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 36 for resistance. • CHECK: Engine Speed Sensor -G28- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 51 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REMOVE: Engine Speed Sensor -G28-. Refer to appropriate repair manual. ♦ CHECK: Engine Speed Sensor -G28- sensor wheel for proper seating, damage and/or run - out. Repair as required. Refer to appropriate repair manual. ♦ Sensor wheel OK. ♦ REPLACE: Engine Speed Sensor -G28-. ♦ GO TO: Step 4 ⇒ page 240 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 240 .
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.14 EVAP Canister Purge Regulator Valve 1 - N80-, Checking

General Description

EVAP system is designed so that the admission of fuel vapors takes place only at idle and at light part-throttle. The EVAP Canister Purge Regulator Valve 1 -N80- is activated by the Engine Control Module -J623- to accomplish this task.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.

◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 241 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: EVAP Canister Purge Regulator Valve 1 -N80- harness connector. • CHECK: EVAP Canister Purge Regulator Valve 1 -N80- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 15 – 35 Ω (+/- 5 Ω). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 241 . – NO: ◆ REPLACE: EVAP Canister Purge Regulator Valve 1 -N80-. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 242 .
3	• IGNITION: ON. • CHECK: EVAP Canister Purge Regulator Valve 1 -N80- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 242 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 242 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: EVAP Canister Purge Regulator Valve 1 -N80- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 23 for resistance. • SPECIFIED VALUE: 15 – 35 Ω (+/- 5 Ω). – Was Value obtained?	– YES: ♦ TIP: The EVAP Canister Purge Regulator Valve 1 -N80- may fail under loaded operation; please swap a known good EVAP Canister Purge Regulator Valve 1 -N80- prior to continuing to the next step. ♦ GO TO: Step 5 ⇒ page 242 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 242 .
5	• Final Procedure • Perform a road test to verify repair. Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.15 EVAP Canister Purge Regulator Valve 2 - N115-, Checking

General Description

EVAP system is designed so that the admission of fuel vapors takes place only at idle and at light part-throttle. The EVAP Canister Purge Regulator Valve 2 -N115- is activated by the Engine Control Module -J623- to accomplish this task.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.

- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 243 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: EVAP Canister Purge Regulator Valve 2 -N115- harness connector. • CHECK: EVAP Canister Purge Regulator Valve 2 -N115- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 15 – 35 Ω (+/- 5 Ω). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 243 . – NO: ◆ REPLACE: EVAP Canister Purge Regulator Valve 2 -N115-. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 244 .
3	• IGNITION: ON. • CHECK: EVAP Canister Purge Regulator Valve 2 -N115- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 244 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 244 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: EVAP Canister Purge Regulator Valve 2 -N115- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 8 for resistance. • SPECIFIED VALUE: 15 – 35 Ω (+/- 5 Ω). – Was Value obtained?	– YES: ♦ TIP: The EVAP Canister Purge Regulator Valve 2 -N115- may fail under loaded operation; please swap a known good EVAP Canister Purge Regulator Valve 2 -N115- prior to continuing to the next step. ♦ GO TO: Step 5 ⇒ page 244 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 244 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.16 Exhaust Camshaft Adjustment Valve 1 - N318-, Checking

The camshaft's task is to operate the valves at the right time and in the right order to control the charge cycle. Camshaft adjustment using the Exhaust Camshaft Adjustment Valve 1 - N318- varies the opening times of the valves to suit all operating conditions. This ensures ideal charge cycles within a wide range of engine speeds and loads. Fuel consumption and pollutant emissions are reduced, torque and smoothness increased. In engines with a double overhead camshaft the size and positioning of the valve opening overlap can be influenced, enhancing characteristics in full-load and part-load operation. In continuous camshaft adjustment, the adjustment is infinitely variable within specific parameters.

Special tools and workshop equipment required

♦ Multimeter.

- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 245 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Exhaust Camshaft Adjustment Valve 1 - N318- harness connector. • CHECK: Exhaust Camshaft Adjustment Valve 1 - N318- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 5-30 Ω (+/- 5 Ω @ approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 245 . – NO: ♦ REPLACE: Exhaust Camshaft Adjustment Valve 1 - N318-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 246 .
3	• IGNITION: ON. • CHECK: Exhaust Camshaft Adjustment Valve 1 - N318- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 246 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 246 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Exhaust Camshaft Adjustment Valve 1 - N318- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 5 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ TIP: The Exhaust Camshaft Adjustment Valve 1 - N318- may fail under loaded operation; please swap a known good Exhaust Camshaft Adjustment Valve 1 - N318- prior to continuing to the next step. ♦ GO TO: Step 5 ⇒ page 246 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 246 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.17 Fuel Delivery Unit -GX1- / Fuel Pump Control Module - J538-, Testing

General Description

The Engine Control Module -J623- tells the Fuel Pump Control Module -J538- the demand needed for fuel volume and pressure and activates the Transfer Fuel Pump -G6-. The Transfer Fuel Pump -G6- transfers fuel to the rest of the fuel system, where it is monitored by the Engine Control Module -J623- through sensors, and controlled through regulators and/or metering valves.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Note

When the door is opened or the Ignition is turned to the ON position the fuel pump is activated for 2 seconds to build up the pressure in the fuel system.

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ", page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 247 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: ON. • LISTEN: Transfer Fuel Pump -G6- should be heard running for 2 s. • IGNITION: OFF. • SPECIFIED VALUE: Transfer Fuel Pump ON for 2 s. – Was Value obtained?	– YES: ♦ Condition may be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 248 . – NO: ♦ GO TO: Step 3 ⇒ page 247 .
3	• DISCONNECT: Fuel Pump Control Module. -J538- harness connector. • IGNITION: ON. • CHECK: Fuel Pump Control Module -J538- harness connector terminals 1 and 3 to 6 for voltage. • CHECK: Fuel Pump Control Module -J538- harness connector terminal 6 to battery voltage for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 248 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 248 .

Step	Procedure	Result / Action to Take
4	• RECONNECT: Fuel Pump Control Module -J538- harness connector. • DISCONNECT: Transfer Fuel Pump -G6- harness connector. • CRANK: Engine. • CHECK: Transfer Fuel Pump -G6- harness connector terminals 1 to 5 for voltage while engine is cranking. • IGNITION: OFF. • SPECIFIED VALUE: 7 – 11 V. – Was Value obtained?	– YES: ♦ REPLACE: Transfer Fuel Pump -G6-, Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 248 . – NO: ♦ GO TO: Step 5 ⇒ page 248 .
5	• REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • DISCONNECT: Fuel Pump Control Module -J538- harness connector. • CHECK: Fuel Pump Control Module -J538- harness connector terminal 2 to Engine Control Module -J623- harness connector terminal T94 / 27 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ REPLACE: Fuel Pump Control Module -J538-. Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 248 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 248 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.18 Fuel Filler Detection Switch -F334-, Checking

General Description

The Fuel Filler Detection Switch -F334- closes when the fuel filler door closes. The Vehicle Electrical System Control Module

-J519- monitors this action and reports the Fuel Filler Detection Switch -F334- position to the Engine Control Module -J623-.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 249 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Fuel Filler Detection Switch -F334- harness connector. • DISCONNECT: Vehicle Electrical System Control Module -J519- harness connectors. • CHECK: Fuel Filler Detection Switch -F334- harness connector terminal 1 to Vehicle Electrical System Control Module -J519- T52a / 46 for resistance. • CHECK: Fuel Filler Detection Switch -F334- harness connector terminal 3 to Vehicle Electrical System Control Module -J519- T52a / 32 for resistance. • CHECK: Fuel Filler Detection Switch -F334- harness connector terminal 4 to Vehicle Electrical System Control Module -J519- T52b / 5 for resistance. • CHECK: Fuel Filler Detection Switch -F334- harness connector terminal 2 to ground for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Fuel Filler Detection Switch -F334-. Refer to appropriate repair manual. ♦ GO TO: Step 3 ⇒ page 250 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 3 ⇒ page 250 .

Step	Procedure	Result / Action to Take
3	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Vehicle Electrical System Control Module -J519- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Vehicle Electrical System Control Module -J519-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.19 Fuel Injectors, Checking

General Description

The Fuel Injectors are controlled by the Engine Control Module -J623- and are mounted normally in the cylinder head. The fuel injectors spray high-pressure atomized fuel directly into the combustion chamber.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.
- ◆ LED Test Lamp.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ", page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 251 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Harness connector from suspect Fuel Injector. • CHECK: Suspect Fuel Injector component connector terminals 1 to 2 for resistance (refer to the wiring diagram for proper terminal locations). • SPECIFIED VALUE: 0.5 – 15 Ω (@ 20° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 251 . – NO: ◆ REPLACE: Suspect Fuel Injector(s). Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 251 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Suspect Fuel Injector harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / xx (refer to the wiring diagram for proper terminal locations). • CHECK: Suspect Fuel Injector harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / xx (refer to the wiring diagram for proper terminal locations). • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ TIP: The Fuel Injector may fail under loaded operation; please swap a known good Fuel Injector prior to continuing to the next step. ◆ GO TO: Step 4 ⇒ page 251 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 251 .
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.20 Fuel Pressure Regulator Valve - N276-, Checking

General Description

The Engine Control Module -J623- regulates Fuel Pressure Regulator Valve -N276- directly at the High Pressure Fuel Pump to control the low pressure valve inside the High Pressure Fuel Pump.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 252 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Fuel Pressure Regulator Valve -N276- harness connector. • CHECK: Fuel Pressure Regulator Valve -N276- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 1.5 – 11 Ω (@ 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 253 . – NO: ♦ REPLACE: Fuel Pressure Regulator Valve -N276-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 253 .

Step	Procedure	Result / Action to Take
3	• IGNITION: ON. • CHECK: Fuel Pressure Regulator Valve - N276- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 253 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 253 .
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Fuel Pressure Regulator Valve - N276- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 19 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ TIP: The Fuel Pressure Regulator Valve -N276- may fail under loaded operation; please swap a known good Fuel Pressure Regulator Valve -N276- prior to continuing to the next step. ◆ GO TO: Step 5 ⇒ page 253 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 253 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.21 Fuel Pressure Sensor -G247-, Checking

General Description

The Fuel Pressure Sensor -G247- measures the fuel pressure in the high-pressure fuel system. The Engine Control Module -J623- analyzes the signal and regulates the fuel high pressure through the Fuel Pressure Regulator Valve -N276- or (depending on vehicle) in the high-pressure pump.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 254 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Fuel Pressure Sensor -G247- harness connector. • IGNITION: ON. • CHECK: Fuel Pressure Sensor -G247- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 255 . – NO: ♦ GO TO: Step 4 ⇒ page 255 .

Step	Procedure	Result / Action to Take
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Fuel Pressure Sensor -G247- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 25 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Fuel Pressure Sensor -G247-. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 255 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 255 .
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Fuel Pressure Sensor -G247- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 37 for resistance. • CHECK: Fuel Pressure Sensor -G247- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 14 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 255 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 255 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.22 Fuel Tank Pressure Sensor - G400-, Checking

General Description

The evaporative system integrity can be tested by applying a vacuum signal to the fuel tank in order to create a small vacuum. The Engine Control Module -J623- then monitors the

ability of the system to maintain the vacuum through signals sent from the Fuel Tank Pressure Sensor -G400-. If the vacuum remains for a specified period of time, then there are no evaporative leaks detected, and a PASS is reported by the Engine Control Module -J623-. If there is a leak, the system either will not achieve a vacuum, nor maintain the vacuum.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 256 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Fuel Tank Pressure Sensor -G400- harness connector. • IGNITION: ON. • CHECK: Fuel Tank Pressure Sensor -G400- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 257 . – NO: ♦ GO TO: Step 4 ⇒ page 257 .

Step	Procedure	Result / Action to Take
3	• REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Fuel Tank Pressure Sensor -G400- harness connector terminal 2 to Engine Control Module -J623- harness connector T94 / 53 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Fuel Tank Pressure Sensor -G400-. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 257 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 257 .
4	• REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Fuel Tank Pressure Sensor -G400- harness connector terminal 1 to Engine Control Module -J623- harness connector T94 / 63 for resistance. • CHECK: Fuel Tank Pressure Sensor -G400- harness connector terminal 3 to Engine Control Module -J623- harness connector T94 / 14 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 257 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 257 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.23 High Temperature Coolant Pump - V467-, Checking

General Description

The e-machine is water-cooled through an integrated high temperature cooling circuit of the internal combustion engine. Engine coolant is circulated by the High Temperature Circuit Cool-

ant Pump -V467- in three stages as required. The High Temperature Circuit Coolant Pump - V467- is controlled by the Engine Control Module -J623-.

Electric Drive Power And Control Electronics -JX1- has its own low temperature cooling circuit, which is connected to the coolant reservoir of the engine cooling circuit. Coolant is recirculated as required by Low Temperature Circuit Coolant Pump -V468-. The low temperature circuit is a component part of the thermal management system. The Engine Control Module -J623- controls pump activation. The ECM supplies the power electronics with information on brake energy recuperation, generator operation, and driving speed when driving under electric power.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 258 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: High Temperature Circuit Coolant Pump - V467- harness connector. • IGNITION: ON. • CHECK: High Temperature Circuit Coolant Pump - V467- harness connector terminals 2 to 1 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 259 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 259 .

Step	Procedure	Result / Action to Take
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: High Temperature Circuit Coolant Pump - V467- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 21 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ REPLACE: High Temperature Circuit Coolant Pump - V467-. Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 259 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 259 .
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.8.24 Ignition Coils with Power Output Stage, Checking

General Description

The ignition coil must transform the relatively low 12 V on-board vehicle voltage to the high ignition voltage required and supply the energy stored in that voltage to the spark plug. The functional principle of the ignition coil is relatively simple. It has a primary winding (small number of turns) and a secondary winding (lots of turns). The turn ratio between the number of primary and secondary winding turns determines the level of the voltage generated at the output. Ignition Coils With Power Output Stage are plugged directly into the spark plug. This means that the ignition energy can be transferred directly to the spark plug with virtually zero power loss.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

- ♦ Scan Tool.
- ♦ LED Test Lamp.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 260 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Suspect Ignition Coil With Power Output Stage harness connector. • IGNITION: ON. • CHECK: Suspect Ignition Coil With Power Output Stage harness connector terminals 4 to 1 and 3 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 260 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 261 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Suspect Ignition Coil With Power Output Stage harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / xx for resistance. Refer to appropriate wiring diagram for proper terminal locations. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 261 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 261 .

Step	Procedure	Result / Action to Take
4	• DISCONNECT: All of the Fuel Injectors. Refer to appropriate wiring diagram. • DISCONNECT: Cold Start Injector (If applicable). • CONNECT: Engine Control Module - J623- harness connector. • CONNECT: LED Test Lamp to Suspect Ignition Coil With Power Output Stage harness connector terminals 2 to ground. • CRANK: Engine. • SPECIFIED VALUE: LED Test Lamp should Flicker ON & OFF. – Was Value obtained?	– YES: ◆ REPLACE: Ignition Coil With Power Output Stage. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 261 . – NO: ◆ GO TO: Step 5 ⇒ page 261 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.25 Intake Manifold Sensor -GX9-, Checking

General Description

Air mass and charge pressure are two factors used for engine load management. For this purpose, there are several sensors with absolutely identical functions. They measure the intake air temperature and the intake manifold pressure. The first sender unit is located upstream of the Throttle Valve Control Module -J338/GX3- in the Intake Manifold Sensor -GX9-. They measure the pressure and temperature of the air in each individual cylinder bank. The values measured here correspond to the actual air mass in the cylinder bank(s).

The Intake Manifold Sensor -GX9- contains the following components:

- Intake Air Temperature Sensor 2 -G299-.
- Manifold Absolute Pressure Sensor -G71-.

The Intake Manifold Sensor -GX9- components cannot be serviced separately, it must be serviced as a unit.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 262 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: ON. • DISCONNECT: Intake Manifold Sensor -GX9- harness connector. • CHECK: Intake Manifold Sensor -GX9- harness connector terminals 3 to 1 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 262 . – NO: ♦ GO TO: Step 4 ⇒ page 263 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Intake Manifold Sensor -GX9- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 13 for resistance. • CHECK: Intake Manifold Sensor -GX9- harness connector terminal 4 to the Engine Control Module - J623- harness connector T60 / 11 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω) – Were Values obtained?	– YES: ♦ REPLACE: Intake Manifold Sensor -GX9-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 263 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 263 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Intake Manifold Sensor -GX9- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 37 for resistance. • CHECK: Intake Manifold Sensor -GX9- harness connector terminal 1 to T60 / 14 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 263 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 263 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.26 Knock Sensor 1 -G61-, Checking

General Description

The Knock Sensor 1 -G61- is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The Engine Control Module -J623- uses this signal to determine the presence of engine knock and to retard spark timing, if necessary.

Special tools and workshop equipment required

◆ Multimeter.

◆ Wiring Diagram.

◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".

- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Note

- *Prior to beginning the test procedure, make sure to check the items listed below:*
- *Poor fuel quality*
- *Ignition timing malfunction*
- *Loose components on the engine block*
- *Engine temperature must be in the normal range*

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 264 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • CONNECT: Scan tool. • START: Engine and let Idle. • CHECK: The ignition advance timing value. • TAP: Near the Knock Sensor 1 -G61- area and monitor for any fluctuations in the ignition timing advance value. • IGNITION: OFF. • SPECIFIED VALUE: 1 – 10 degrees of ignition timing fluctuation. – Was Value obtained?	– YES: ♦ Condition may be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 265 . – NO: ♦ GO TO: Step 3 ⇒ page 264 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • DISCONNECT: Knock Sensor 1 -G61- harness connector. • CHECK: Knock Sensor 1 -G61- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 39 for resistance. • CHECK: Knock Sensor 1 -G61- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 54 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ TIP: The Knock Sensor 1 -G61- may fail under loaded operation; please swap a known good Knock Sensor 1 -G61- prior to continuing to the next step. ♦ GO TO: Step 4 ⇒ page 265 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 265 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return, the repair is complete. ◆ Return vehicle to customer.

3.8.27 Leak Detection Pump - V144-, Checking

General Description

Whenever the engine is running, vacuum is applied to the Vacuum Switch. This switch applies vacuum to the Upper Chamber of the pump when it receives a ground signal from the Engine Control Module -J623-. This signal is a duty cycle pulse of approximately 40%. When vacuum is applied to the Upper Chamber, fresh air flows in through the One-way Inlet Valve, compressing the spring above the diaphragm. When the Diaphragm begins to rise, the Reed Switch, attached to the Diaphragm Rod, opens. When the Vacuum Switch closes, the vacuum in the Upper Chamber is released. As a result, the spring pushes the Diaphragm down. As the Diaphragm is pushed down, the air in the Lower Chamber is pushed out of the One-way Outlet Valve into the EVAP system. This process continues until the pressure in the EVAP system no longer allows the spring to push the Diaphragm down. With tension on the Diaphragm, the ECM waits for a certain period of time to watch for the Diaphragm to fall. The Reed Switch closing signals that the Diaphragm has fallen to its lowest point. When the Reed Switch closes, the ECM may cycle the LDP to build up system pressure again. The ECM measures the time it takes for the Reed Switch to close once the LDP has stopped running to determine if there is a leak in the system. The slower the Diaphragm falls after the pump stops running, the less air is leaking out of the EVAP system.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.
- Hand Vacuum Pump.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 266 . – NO: ♦ GATHER more information from customer about the complaint.
2	• REMOVE: Evaporative Canister. Refer to appropriate repair manual. • Plug or Cap off the Leak Detection Pump - V144- hose going to the vent filter. • CONNECT: Hand vacuum pump to the Leak Detection Pump - V144- and apply 0.700 bar and see if the vacuum holds. – Did the vacuum hold?	– YES: ♦ GO TO Step 3 ⇒ page 266 . – NO: ♦ REPLACE: Leak Detection Pump - V144-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 267 .
3	• IGNITION: OFF. • DISCONNECT: Leak Detection Pump -V144- harness connector. • IGNITION: ON. • CHECK: Leak Detection Pump -V144- harness connector terminal 4 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 267 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 267 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Leak Detection Pump -V144- harness connector terminal 1 to the Engine Control Module -J623- harness connector T94 / 31 for resistance. • CHECK: Leak Detection Pump -V144- harness connector terminal 2 to the Engine Control Module -J623- harness connector T94 / 72 for resistance. • CHECK: Leak Detection Pump -V144- harness connector terminal 3 to the Engine Control Module -J623- harness connector T94 / 50 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Leak Detection Pump -V144-. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 267 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 267 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.28 Low Temperature Circuit Coolant Pump - V468-, Checking

General Description

The e-machine is water-cooled through an integrated high temperature cooling circuit of the internal combustion engine. Engine coolant is circulated by High Temperature Circuit Coolant Pump -V467- in three stages as required. The High Temperature Circuit Coolant Pump - V467- is controlled by Engine Control Module -J623-.

Electric Drive Power And Control Electronics -JX1- has its own low temperature cooling circuit, which is connected to the coolant reservoir of the engine cooling circuit. Coolant is recirculated as required by Low Temperature Circuit Coolant Pump -V468-. The low temperature circuit is a component part of the thermal management system. The Engine Control Module -J623- controls pump activation. The ECM supplies the power electronics with information on brake energy recuperation, gen-

erator operation, and driving speed when driving under electric power.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ C3.1 heck ”, page 19 . – Was concern verified?	– YES: ♦ GO TO: Step 2 ⇒ page 268 . – NO: ♦ GATHER more information from customer about the concern.
2	• IGNITION: OFF. • DISCONNECT: Low Temperature Circuit Coolant Pump -V468- harness connector. • IGNITION: ON. • CHECK: Low Temperature Circuit Coolant Pump -V468- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 268 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 269 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Low Temperature Circuit Coolant Pump -V468- harness connector terminal 2 to Engine Control Module - J623- harness connector T94 / 94 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ REPLACE: Low Temperature Circuit Coolant Pump -V468- ♦ GO TO: Step 4 ⇒ page 269 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 269 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.29 Motronic Engine Control Module Power Supply Relay -J271-, Checking

General Description

The following procedure is used to diagnose the Motronic Engine Control Module Power Supply Relay -J271- and the Engine Control Module -J623- power supply voltage that is provided by the Motronic Engine Control Module Power Supply Relay -J271-.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ", page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 270 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Motronic Engine Control Module Power Supply Relay -J271-. Refer to appropriate repair manual. • IGNITION: ON. • CHECK: Motronic Engine Control Module Power Supply Relay -J271- socket terminals 86 and 30 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 270 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 271 .
3	• REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CONNECT: Jumper wire Motronic Engine Control Module Power Supply Relay -J271- socket terminals 30 and 87. • IGNITION: ON. • CHECK: Engine Control Module -J623- harness connector T94 / 3 and T94 / 5 and T94 / 6 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 270 . – NO: ◆ GO TO: Step 5 ⇒ page 271 .
4	• REMOVE: Jumper wire Motronic Engine Control Module Power Supply Relay -J271- socket terminals 30 and 87. • CHECK: Motronic Engine Control Module Power Supply Relay -J271- socket terminal 85 to the Engine Control Module -J623- harness connector T94 / 69 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Motronic Engine Control Module Power Supply Relay -J271-. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 271 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 271 .

Step	Procedure	Result / Action to Take
5	• REMOVE: Jumper wire Motronic Engine Control Module Power Supply Relay -J271- socket terminals 30 and 87. • REMOVE: Appropriate fuse. Refer to the wiring diagram for correct fuse. • CHECK: Downstream (output) side of Appropriate fuse. Refer to the wiring diagram for correct fuse to Engine Control Module -J623- harness connector T94 / 3 and T94 / 5 and T94 / 6 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Fuse panel. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 271 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 271 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.30 Outside Air Temperature Sensor -G17-, Checking

General Description

The ambient or Outside Air Temperature Sensor -G17- is a negative temperature coefficient (NTC) sensor that informs the semiautomatic / automatic temperature control system of outside air temperature. An NTC sensor resistance decreases as the temperature increases. The computer uses this input along with different in-car temperature sensors to control temperature and blower speed. When there is a problem with this sensor, performance will suffer and the compressor clutch may not engage.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 272 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Outside Air Temperature Sensor -G17- harness connector. • CHECK: Outside Air Temperature Sensor -G17- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 1,300 Ω (+/- 500 Ω @ approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 272 . – NO: ♦ REPLACE: Outside Air Temperature Sensor -G17-. Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 273 .
3	• REMOVE: Instrument Cluster Control Module -J285-. Refer to appropriate repair manual. • CHECK: Outside Air Temperature Sensor -G17- harness connector terminal 1 to the Instrument Cluster Control Module -J285- harness connector T32 / 20 for resistance. • CHECK: Outside Air Temperature Sensor -G17- harness connector terminal 2 to the Instrument Cluster Control Module -J285- harness connector T32 / 19 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ TIP: The Outside Air Temperature Sensor -G17- may fail under loaded operation; please swap a known good Outside Air Temperature Sensor -G17- prior to continuing to the next step. ♦ GO TO: Step 4 ⇒ page 273 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 273 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Instrument Cluster Control Module -J285- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Instrument Cluster Control Module -J285-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.31 Oxygen Sensor 1 After Catalytic Converter -GX7-, Checking

General Description

The Oxygen Sensor 1 After Catalytic Converter -GX7- downstream of the primary catalytic converter supplies the Engine Control Module -J623- with a voltage signal (nonlinear) indicating "rich" or "lean. If the primary catalytic converter is supersaturated with oxygen (lean mixture), Oxygen Sensor 1 After Catalytic Converter -GX7- will send the Engine Control Module -J623- a nonlinear signal indicating the lean mixture condition. The mixture is then enriched with fuel until the oxygen has been "displaced" from the catalytic converter. This condition, in turn, is registered by Oxygen Sensor 1 After Catalytic Converter -GX7- as a nonlinear signal indicating the rich mixture condition. The mixture is then leaned out by the Engine Control Module -J623-. If the nonlinear signal is received again, the mixture will again be enriched. The frequency, or period, during which the mixture is enriched or leaned out is variable, being dependent on the gas flow rate (engine load) at that moment.

Note the Oxygen Sensor 1 After Catalytic Converter -GX7- is also referred to as the Oxygen Sensor After Three Way Catalytic Converter -G130-.

The Oxygen Sensor 1 After Catalytic Converter -GX7- contains the following components:

♦ Oxygen Sensor After Three Way Catalytic Converter -G130-

♦ Heater For Oxygen Sensor 1 After Catalytic Converter -Z29-

The Oxygen Sensor 1 After Catalytic Converter -GX7- components cannot be serviced separately, it must be serviced as a unit.

Special tools and workshop equipment required

♦ Multimeter.

- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to Oxygen Sensor Preliminary Tests in ⇒ C3.1 heck”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 274 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector. • CHECK: Oxygen Sensor 1 After Catalytic Converter -GX7- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 2 – 4 Ω (+/- 0.5 Ω @ 25° C).. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 274 – NO: ♦ REPLACE: Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 275 .
3	• IGNITION: ON. • CHECK: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 275 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 275 .

Step	Procedure	Result / Action to Take
4	• RECONNECT: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector. • CONNECT: Scan Tool. • START: Engine and let Idle. • Perform the function test located in diagnostic mode 06. Refer to appropriate Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, ⇒ M3.3.9 ode 06 - Read Test Results for Specific Diagnostic Functions, 2013 – 2014 MY", page 31 . • IGNITION: OFF. • SPECIFIED VALUE: Mode 6 Pass. – Were Values obtained?	– YES: ◆ FAULT: Is intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 275 . – NO: ◆ GO TO: Step 5 ⇒ page 275 .
5	• DISCONNECT: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector. • REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector terminal 4 to the Engine Control Module -J623- harness connector T94 / 55 for resistance. • CHECK: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector terminal 3 to the Engine Control Module -J623- harness connector T94 / 54 for resistance. • CHECK: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector terminal 2 to the Engine Control Module -J623- harness connector T94 / 29 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 275 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 275 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.32 Oxygen Sensor 1 Before Catalytic Converter -GX10-, Checking

General Description

The Oxygen Sensor 1 Before Catalytic Converter -GX10- does not actually measure oxygen concentration, but rather the difference between the amount of oxygen in the exhaust gas and the amount of oxygen in air. Rich mixture causes an oxygen demand. This demand causes a voltage to build up, due to transportation of oxygen ions through the Oxygen Sensor 1 Before Catalytic Converter -GX10- layer. Lean mixture causes low voltage, since there is an oxygen excess. The Oxygen Sensor 1 Before Catalytic Converter -GX10- and catalytic converters are used in order to reduce exhaust emissions. Information on oxygen concentration is sent to Engine Control Module -J623-, which adjusts the amount of fuel injected into the engine to compensate for excess air or excess fuel. The Engine Control Module -J623- attempts to maintain, on average, a certain air–fuel ratio by interpreting the information it gains from the Oxygen Sensor 1 Before Catalytic Converter -GX10-. The primary goal is a compromise between power, fuel economy, and emissions. The heater for Oxygen Sensor 1 Before Catalytic Converter -GX10- is designed to minimize the time-to-readiness for closed-loop operation by heating the Oxygen Sensor 1 Before Catalytic Converter -GX10- as quickly as possible.

Note the Oxygen Sensor 1 Before Catalytic Converter -GX10- is also referred to as the Heated Oxygen Sensor -G39-.

The Oxygen Sensor 1 Before Catalytic Converter -GX10- contains the following components:

- Heated Oxygen Sensor -G39-
- Oxygen Sensor Heater -Z19-

The Oxygen Sensor 1 Before Catalytic Converter -GX10- components cannot be serviced separately, and must be serviced as a unit.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to Oxygen Sensor Preliminary Tests in ⇒ C3.1 heck ", page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 277 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- component connector terminals 3 to 4 for resistance. • SPECIFIED VALUE: 2 – 4 Ω (+/- 0.5 Ω @ 25° C).. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 277 . – NO: ♦ REPLACE: Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 278 .
3	• IGNITION: ON. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector terminal 4 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 277 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 278 .
4	• RECONNECT: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector. • CONNECT: Scan Tool. • START: Engine and let Idle. • Perform the function test located in diagnostic mode 06. Refer to appropriate Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, ⇒ M3.3 odes 01 - 0A", page 22 . • IGNITION: OFF. • SPECIFIED VALUE: Mode 6 Pass. – Were Values obtained?	– YES: ♦ FAULT: Is intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 278 . – NO: ♦ GO TO: Step 5 ⇒ page 278 .

Step	Procedure	Result / Action to Take
5	• DISCONNECT: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector. • REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector terminal 1 to the Engine Control Module -J623- harness connector T94 / 60 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector terminal 2 to the Engine Control Module -J623- harness connector T94 / 61 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector terminal 3 to the Engine Control Module -J623- harness connector T94 / 51 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector terminal 5 to the Engine Control Module -J623- harness connector T94 / 81 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector terminal 6 to the Engine Control Module -J623- harness connector T94 / 82 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 278 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 278 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.33 Oxygen Sensor 2 Before Catalytic Converter -GX11-, Checking

General Description

The Oxygen Sensor 2 Before Catalytic Converter -GX11- does not actually measure oxygen concentration, but rather the differ-

ence between the amount of oxygen in the exhaust gas and the amount of oxygen in the air. Rich mixture causes an oxygen demand. This demand causes a voltage to build up, due to transportation of oxygen ions through the Oxygen Sensor 2 Before Catalytic Converter -GX11- layer. Lean mixture causes low voltage, since there is an oxygen excess. The Oxygen Sensor 2 Before Catalytic Converter -GX11- and catalytic converters are used in order to reduce exhaust emissions. Information on oxygen concentration is sent to Engine Control Module -J623-, which adjusts the amount of fuel injected into the engine to compensate for excess air or excess fuel. The Engine Control Module -J623- attempts to maintain, on average, a certain air–fuel ratio by interpreting the information it gains from the Oxygen Sensor 2 Before Catalytic Converter -GX11-. The primary goal is a compromise between power, fuel economy, and emissions. The heater for Oxygen Sensor 2 Before Catalytic Converter -GX11- is designed to minimize the time-to-readiness for closed-loop operation by heating the Oxygen Sensor 2 Before Catalytic Converter -GX11- as quickly as possible.

Note the Oxygen Sensor 2 Before Catalytic Converter -GX11- is also referred to as the Heated Oxygen Sensor 2 -G108-.

The Oxygen Sensor 2 Before Catalytic Converter -GX11- contains the following components:

- Oxygen Sensor 2 Heater -Z28-
- Heated Oxygen Sensor 2 -G108-

The Oxygen Sensor 2 Before Catalytic Converter -GX11- components cannot be serviced separately, it must be serviced as a unit.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to Oxygen Sensor Preliminary Tests in ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 280 . – NO: ♦ GATHER more information from customer about the complaint.

Step	Procedure	Result / Action to Take
2	• IGNITION: OFF. • DISCONNECT: Oxygen Sensor 2 Before Catalytic Converter -GX11- harness connector. • CHECK: Oxygen Sensor 2 Before Catalytic Converter -GX11- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 2 – 4 Ω (+/- 0.5 Ω @ 25° C).. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 280 . – NO: ◆ REPLACE: Oxygen Sensor 2 Before Catalytic Converter -GX11-. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 281 .
3	• IGNITION: ON. • CHECK: Oxygen Sensor 2 Before Catalytic Converter -GX11- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 280 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 281 .
4	• RECONNECT: Oxygen Sensor 2 Before Catalytic Converter -GX11- harness connector. • CONNECT: Scan Tool. • START: Engine and let Idle. • Perform the function test located in diagnostic mode 06. Refer to appropriate Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, ⇒ M3.3 odes 01 - 0A", page 22 . • IGNITION: OFF. • SPECIFIED VALUE: Mode 6 Pass. – Were Values obtained?	– YES: ◆ FAULT: Is intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 281 . – NO: ◆ GO TO: Step 5 ⇒ page 280 .
5	• DISCONNECT: Oxygen Sensor 2 Before Catalytic Converter -GX11- harness connector. • REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Oxygen Sensor 2 Before Catalytic Converter -GX11- harness connector terminal 2 to the Engine Control Module -J623- harness connector T94 / 7 for resistance. • CHECK: Oxygen Sensor 2 Before Catalytic Converter -GX11- harness connector terminal 3 to the Engine Control Module -J623- harness connector T94 / 76 for resistance. • CHECK: Oxygen Sensor 2 Before Catalytic Converter -GX11- harness connector terminal 4 to the Engine Control Module -J623- harness connector T94 / 77 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Oxygen Sensor 2 Before Catalytic Converter -GX11-. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 281 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 281 .

Step	Procedure	Result / Action to Take
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.34 Positive Crankcase Ventilation Heating Element -N79-, Checking

General Description

The Positive Crankcase Ventilation Heating Element -N79- heats the positive crankcase ventilation valve, which allows the valve to quickly dissipate the crankcase gases into the intake manifold when the engine is below normal engine operating temperature.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck " page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 282 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Positive Crankcase Ventilation Heating Element -N79- harness connector. • CHECK: Positive Crankcase Ventilation Heating Element -N79- component connector terminals 1 to 2 to ground for resistance. • SPECIFIED VALUE: 2 – 4 Ω (+/- 0.5 Ω @ 25° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 282 . – NO: ◆ PERFORM: Visual Inspection of component grounding point. ◆ REPAIR: Component grounding point. ◆ If component is properly grounded, then: ◆ REPLACE: Positive Crankcase Ventilation Heating Element -N79-. Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 283 .
3	• REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Positive Crankcase Ventilation Heating Element -N79- harness connector terminal 1 to the Engine Control Module -J623- harness connector T94 / 42 for resistance. • CHECK: Positive Crankcase Ventilation Heating Element -N79- harness connector terminal 2 to the Engine Control Module -J623- harness connector T60 / 55 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ TIP: The Positive Crankcase Ventilation Heating Element -N79- may fail under loaded operation; please swap a known good Positive Crankcase Ventilation Heating Element -N79- prior to continuing to the next step. ◆ GO TO: Step 4 ⇒ page 283 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 283 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.8.35 Secondary Air Injection Pump Relay - J299- / Secondary Air Injection Pump Motor - V101-, Checking

General Description

The secondary air injection system sends air into the exhaust using passages in the cylinder head. This extra air injection takes place using the Secondary Air Injection Pump Motor -V101- that is powered by the Secondary Air Injection Pump Relay -J299- on a cold-start of the engine for about 45 – 100 sec. and serves to quickly heat the catalytic converter(s) for improved emissions.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ", page 19 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 284 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • REMOVE:Secondary Air Injection Pump Relay -J299- from fuse box. Refer to appropriate repair manual. • IGNITION: ON. • CHECK: Secondary Air Injection Pump Relay -J299- socket terminals 30a and 86 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 284 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 285 .
3	• CONNECT: Jumper wire, Secondary Air Injection Pump Relay -J299- socket terminals 30a and 87. • IGNITION: ON. • SPECIFIED VALUE:Secondary Air Injection Pump Motor -V101- should be heard running. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 284 . – NO: ◆ GO TO: Step 5 ⇒ page 285 .
4	• REMOVE: Jumper wire, Secondary Air Injection Pump Relay -J299- socket terminals 30a and 87. • REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Secondary Air Injection Pump Relay -J299- socket terminal 85 to the Engine Control Module -J623- harness connector T94 / 49 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Secondary Air Injection Pump Relay -J299-. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 285 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 285 .

Step	Procedure	Result / Action to Take
5	• REMOVE: Jumper wire, Secondary Air Injection Pump Relay -J299- socket terminals 30a and 87. • DISCONNECT:Secondary Air Injection Pump Motor -V101- harness connector. • CHECK: Secondary Air Injection Pump Relay -J299- socket terminal 87 to the Secondary Air Injection Pump Motor -V101- harness connector terminal 2 for resistance. • CHECK: Secondary Air Injection Pump Motor -V101- harness connector terminal 1 to ground for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Secondary Air Injection Pump Motor -V101-. Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 285 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 285 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.8.36 Secondary Air System -GX24-, Checking

General Description

The secondary air injection system sends air into the exhaust on a cold-start of the engine for about 45 – 100 sec. and serves to quickly heat the catalytic convertor(s) for improved emissions. A "pressure based secondary air diagnostics" function is used. In this system, the signal from Secondary Air Injection Sensor 1 -G609- is evaluated in the Engine Control Module -J623-. The injected air quantity is determined from the pressure level.

The Secondary Air System -GX24- contains the following components:

♦ Secondary Air Injection Solenoid Valve -N112-

♦ Secondary Air Injection Sensor 1 -G609-

The Secondary Air System -GX24- components cannot be serviced separately, and must be serviced as a unit.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Manual Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ", page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 286 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Secondary Air System -GX24- harness connector. • CHECK: Secondary Air System -GX24- component connector terminals 1 to 5 for resistance. • SPECIFIED VALUE: 5 – 35 Ω (@ 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 286 . – NO: ♦ REPLACE: Secondary Air System -GX24-. Refer to appropriate repair manual. ♦ GO TO: Step 7 ⇒ page 288 .
3	• IGNITION: ON. • CHECK: Secondary Air System -GX24- harness connector terminal 1 to ground for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 287 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 7 ⇒ page 288 .

Step	Procedure	Result / Action to Take
4	• IGNITION: ON. • CHECK: Secondary Air System -GX24- harness connector terminals 2 to 4 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 287 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 287 .
5	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Secondary Air System -GX24- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 40 for resistance. • CHECK: Secondary Air System -GX24- harness connector terminal 5 to the Engine Control Module - J623- harness connector T94 / 73 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Secondary Air System -GX24-. Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 288 . – NO: ◆ GO TO: Step 6 ⇒ page 287 .
6	• CHECK: Secondary Air System -GX24- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 37 for resistance. • CHECK: Secondary Air System -GX24- harness connector terminal 4 to ground for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 7 ⇒ page 288 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 288 .

Step	Procedure	Result / Action to Take
7	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.8.37 Three Way Catalytic Converter (TWC), Checking

General Description

A catalytic converter is a vehicle emissions control device that converts toxic pollutants in exhaust gas to less toxic pollutants by catalyzing a redox reaction (oxidation or reduction). Catalytic converters are used in internal combustion engines.

General recommendations

Oxygen sensors OK.

No leaks or damage to exhaust system.

Prior to repair work, perform a preliminary check to verify the condition. Refer to ⇒ C3.1 heck ", page 19 .

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Manual Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Function test

Step	Procedure	Result / Action to Take
1	Activate Monitors: • Perform the function test in Diagnostic Mode 06. Refer to appropriate Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, ⇒ M3.3 odes 01 - 0A", page 22 . • End diagnosis and switch the ignition off. • If the specified values are exceeded:	♦ Check the exhaust system for leaks. ♦ If necessary, repair the leak(s) in the exhaust system. ♦ GO TO: Step 2 ⇒ page 289 .
2	O2 Sensor Monitoring: • Erase the DTC memory. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . • Perform a road test to verify repair. • If the DTC does not return:	♦ Generate readiness code. Refer to ⇒ C3.2 ode ", page 21 . ♦ If no leaks are found in the exhaust system: ♦ Replace the catalytic converter with front exhaust pipe. Refer to appropriate repair manual. ♦ GO TO: Step 3 ⇒ page 289 .
3	• Final procedure: • Perform a road test to verify repair.	• After the repair work, the following work steps must be performed in the following sequence: • Read the DTC memory. Refer to ⇒ M3.3.7 ode 03 - Read DTC Memory", page 29 . • If necessary, erase the DTC memory. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . • If the DTC memory was erased, generate readiness code. Refer to ⇒ C3.2 ode " page 21 . • Return vehicle to Customer.

3.8.38 Throttle Valve Control Module - GX3-, Checking

General Description

Throttle valve operation occurs by an electric motor identified as EPC Throttle Drive -G186- located within the Throttle Valve Control Module -GX3-. It is controlled by the Engine Control Module - J623- with primary inputs from the Accelerator Pedal Module -GX2- as well as other peripheral inputs from EPC Throttle Drive Angle Sensor 1 -G187- and EPC Throttle Drive Angle Sensor 2 -G188-.

The Throttle Valve Control Module -GX3 / J338- contains the following components:

♦ EPC Throttle Drive -G186-

♦ EPC Throttle Drive Angle Sensor 1 -G187-

♦ EPC Throttle Drive Angle Sensor 2 -G188-

The Throttle Valve Control Module -GX3 / J338- components cannot be serviced separately, and must be serviced as a unit.

Special tools and workshop equipment required

♦ Multimeter.

- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint Verified?	– YES: ♦ GO TO: Step 2 ⇒ page 290 . – NO: ♦ GATHER more information from customer about the complaint.
2	• CONNECT: Scan Tool. • IGNITION: ON. • CHECK: Throttle valve position closed: • SPECIFIED VALUE: 3 – 25%. • DEPRESS: Accelerator pedal slowly to WOT while observing the percentage display. The percentage display must increase uniformly. • CHECK: Throttle valve position at WOT: • SPECIFIED VALUE: 84 – 97%. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 291 . – NO: ♦ GO TO: Step 3 ⇒ page 290 .
3	• REMOVE: Throttle Valve Control Module - GX3- far enough so that the harness connector terminals are accessible. • DISCONNECT: Throttle Valve Control Module - GX3- harness connector. • IGNITION: ON. • CHECK: Throttle Valve Control Module - GX3- harness connector terminals 2 to 6 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Were Values obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 291 . – NO: ♦ GO TO: Step 4 ⇒ page 291 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 28 for resistance. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 6 to the Engine Control Module - J623- harness connector T60 / 29 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 6 ⇒ page 291 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 291 .
5	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 27 for resistance. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 15 for resistance. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 4 to the Engine Control Module - J623- harness connector T60 / 12 for resistance. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 5 to the Engine Control Module - J623- harness connector T60 / 30 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Throttle Valve Control Module - GX3-. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 291 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 291 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.8 ode 04 - Erase DTC Memory", page 30 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.8.39 Vehicle Speed Sensor, Checking

General Description

The Vehicle Speed Signal or VSS measures Transmission / Transaxle output or Wheel Speed from the ABS System. The signal is broadcasted over the CAN Bus. The Engine Control Module -J623- uses this information to modify engine functions such as ignition timing, A/F ratio, transmission shift points, and to initiate diagnostic routines.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck ”, page 19 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 292 . – NO: ♦ GATHER more information from customer about the complaint.
2	• CONNECT: Scan Tool. • ROAD TEST: Vehicle. • CHECK: Scan Tool to Speedometer for accuracy. • SPECIFIED VALUE: Difference ≤ 10%. – Was Value obtained?	– YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 293 . – NO: ♦ GO TO: Step 3 ⇒ page 293 .

Step	Procedure	Result / Action to Take
3	• CHECK: ABS system. • CHECK: ABS DTC's. – Was the ABS system OK?	– YES: ◆ CHECK: CAN Bus wiring from Instrument Cluster Control Module -J285- to ABS Control Module -J104-. ◆ GO TO: Step 4 ⇒ page 293 . – NO: ◆ REPAIR: Any ABS concerns 1st. ◆ GO TO: Step 4 ⇒ page 293 .
4	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ◆ Read the DTC memory. Refer to ⇒ M3.3.7 ode 03 - Read DTC Memory", page 29 . ◆ Perform the diagnostic procedure for that DTC. – NO: ◆ Repair is complete. Generate readiness code. Refer to ⇒ C3.2 ode ", page 21 . ◆ Return vehicle to Customer.

DAB 8-4-22 FB

Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen retailer or other qualified shop. We especially urge you to consult an authorized Volkswagen retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen.

- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.

- Volkswagen is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Volkswagen retailer parts department for the latest information.

- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the Volkswagen Factory Approved Scan Tool (ST).

- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.

- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.

- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it

- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.

- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.

- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.

- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.

- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

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Cautions & Warnings

- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.

- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.

- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly; do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.

- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.

- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.

- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.

- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.

- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.

- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.

- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.

- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).

- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Volkswagen Service technicians should test, disassemble or service the airbag system.

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- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.

- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Volkswagen Service technicians using the Volkswagen Factory Approved Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.

- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.

- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.

back OK

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